NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

THE NETTED HUMANITARIAN: IMPROVING THE INFORMATION AND COMMUNICATIONS TECHNOLOGY ASSESSMENT PROCESS FOR HUMANITARIAN ASSISTANCE/DISASTER RELIEF (HA/DR) MISSIONS

by

Christian X. Gutierrez

March 2013

Thesis Advisor:	Brian Steckler
Second Reader:	Glenn Cook

Approved for public release; distribution is unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

REPORT DOCUMENTATION PAGE			*Form Approved OMB No. 0704–0188*
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202–4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704–0188) Washington DC 20503.			
1. AGENCY USE ONLY *(Leave blank)*	**2. REPORT DATE** March 2013	**3. REPORT TYPE AND DATES COVERED** Master's Thesis	
4. TITLE AND SUBTITLE THE NETTED HUMANITARIAN: IMPROVING THE INFORMATION AND COMMUNICATIONS TECHNOLOGY ASSESSMENT PROCESS FOR HUMANITARIAN ASSISTANCE/DISASTER RELIEF (HA/DR) MISSIONS			**C5. FUNDING NUMBERS**
6. AUTHOR(S) Christian X. Gutierrez			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey, CA 93943–5000			**8. PERFORMING ORGANIZATION REPORT NUMBER**
9. SPONSORING /MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A			**10. SPONSORING/MONITORING AGENCY REPORT NUMBER**
11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government. IRB Protocol number ____N/A ____.			
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited			**12b. DISTRIBUTION CODE** A

13. ABSTRACT (maximum 200 words)

Setting up reliable communications after a disaster is an extremely difficult yet crucial requirement for coordinating relief efforts. Lessons learned from recent humanitarian disasters point to major difficulties in establishing communications to quickly and accurately assess responder needs in the affected area and communicating this information to first responders from government relief agencies, Non-Governmental Organizations (NGOs) and the military.

The military's growing role in Humanitarian Assistance/Disaster Relief (HA/DR) missions makes it imperative that military first responders coordinate with partner relief groups to improve the current assessment and relief processes. The current assessment and relief processes are generally ineffective due to inherent mistrust between responding organizations and lack of experience working together in a chaotic and time-pressed environment.

This research analyzes issues with the current processes utilized by responders in HA/DR missions and researches if "Netted Humanitarian" responders trained in the set up/operation of Hastily Formed Networks (HFN) equipment can improve the process of assessing the ICT situation on the ground following a disaster. It further delves into the possibility that these highly trained individuals will expedite overcoming the communications vacuum that immediately follows a natural disaster, and will be beneficial in coordinating the combined recovery efforts of responding organizations.

14. SUBJECT TERMS Hastily Formed Network, Humanitarian Assistance/Disaster Relief (HA/DR), Wireless Technology, Satellite Communications			**15. NUMBER OF PAGES** 93
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT Unclassified	**18. SECURITY CLASSIFICATION OF THIS PAGE** Unclassified	**19. SECURITY CLASSIFICATION OF ABSTRACT** Unclassified	**20. LIMITATION OF ABSTRACT** UU

NSN 7540–01–280–5500 Standard Form 298 (Rev. 2–89)
Prescribed by ANSI Std. 239–18

THIS PAGE INTENTIONALLY LEFT BLANK

Approved for public release; distribution is unlimited

THE NETTED HUMANITARIAN: IMPROVING THE INFORMATION AND COMMUNICATIONS TECHNOLOGY ASSESSMENT PROCESS FOR HUMANITARIAN ASSISTANCE/DISASTER RELIEF (HA/DR) MISSIONS

Christian X. Gutierrez
Lieutenant, United States Navy
B.A., University of Idaho, 2005

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
March 2013

Author: Christian X. Gutierrez

Approved by: Brian Steckler
Thesis Advisor

Glenn Cook
Second Reader

Dan Boger
Chair, Department of Information Sciences

THIS PAGE INTENTIONALLY LEFT BLANK

ABSTRACT

Setting up reliable communications after a disaster is an extremely difficult yet crucial requirement for coordinating relief efforts. Lessons learned from recent humanitarian disasters point to major difficulties in establishing communications to quickly and accurately assess responder needs in the affected area and communicating this information to first responders from government relief agencies, Non-Governmental Organizations (NGOs) and the military.

The military's growing role in Humanitarian Assistance/Disaster Relief (HA/DR) missions makes it imperative that military first responders coordinate with partner relief groups to improve the current assessment and relief processes. The current assessment and relief processes are generally ineffective due to inherent mistrust between responding organizations and lack of experience working together in a chaotic and time-pressed environment.

This research analyzes issues with the current processes utilized by responders in HA/DR missions and researches if "Netted Humanitarian" responders trained in the set up/operation of Hastily Formed Networks (HFN) equipment can improve the process of assessing the ICT situation on the ground following a disaster. It further delves into the possibility that these highly trained individuals will expedite overcoming the communications vacuum that immediately follows a natural disaster, and will be beneficial in coordinating the combined recovery efforts of responding organizations.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF FIGURES

THIS PAGE INTENTIONALLY LEFT BLANK

LIST OF ACRONYMS AND ABBREVIATIONS

API	Application Programming Interface
BGAN	Broadband Global Area Network
BLOS	Beyond Line of Sight
C2PC	Command and Control Personal Computer
CONOPS	Concept of Operations
COP	Common Operational Picture
COTS	Commercial Off-the-Shelf
DART	Disaster Assistance Response Team
DISA	Defense Information Systems Agency
DSL	Digital Subscriber Line
DTCS	Defense Tactical Communications System
DoD	Department of Defense
EA	Enterprise Architecture
ETC	Emergency Telecommunications Cluster
FACT	First Assessment and Coordination Team
FLAK	Fly Away Kit
FOG	Field Operations Guide
GEO	Geostationary Earth Orbit
GPS	Global Positioning System
HA/DR	Humanitarian Assistance/Disaster Relief
HF	High Frequency
HFN	Hastily Formed Network
ICS	Incident Command System
ICT	Information and Communications Technology
IDP	Internally Displaced People
IERCC	International Emergency Response Coordination Center
IFRC	International Federation of the Red Cross/Red Crescent
IGO	International Governmental Organization
IHC	International Humanitarian Community
ISDN	Integrated Services Digital Network

kbps	Kilo bits per second
LEO	Low Earth Orbit
NGO	Non-Governmental Organization
NIMS	National Incident Management System
NSS	National Security Strategy
NPS	Naval Postgraduate School
NRP	National Response Plan
OTH	Over the Horizon
OTM	On the Move
PLI	Position Location Information
PTT	Push to Talk
RTAT	Rapid Technology Assessment Team
SATCOM	Satellite Communications
SIM	Subscriber Identity Module
SMS	Short Message Service
SOP	Standard Operating Procedure
TTP	Tactics, Training, Procedures
UHF	Ultra High Frequency
UN	United Nations
UNDAC	United Nations Disaster Assessment and Coordination
UN-OCHA	United Nations-Office for the Coordination of Humanitarian Affairs
USAID	United States Agency for International Development
USG	United States Government
VHF	Very High Frequency
VPN	Virtual Private Network
VSAT	Very Small Aperture Terminal
Wi-Fi	Wireless Fidelity as defined by the industry
WiMAX	Wireless Microwave Access

ACKNOWLEDGMENTS

First and foremost I would like to thank my wife, Jennie, and our two wonderful children, Shelby and Caitlyn. I could not have done this without you and am forever grateful for your love and support these past two years. It was very comforting to know that my family was behind me every step of this journey. You inspire me to want to be better at everything in life.

I also must acknowledge the support of Brian Steckler, a wonderful thesis advisor, mentor and friend, and Glenn Cook, who was instrumental in the completion of this work. Sincere thanks to both of you gentlemen.

Finally, I would like to thank LT Chudi Chukwuelue and LCDR Marvin Peredo for their stout friendship and support these past two years. I look forward to continuing our friendship long after graduation.

THIS PAGE INTENTIONALLY LEFT BLANK

I. INTRODUCTION

A. OVERVIEW

Establishing access to reliable communications after a natural disaster or human catastrophe is extremely difficult to achieve, yet it is a crucial requirement in order to coordinate relief efforts. However, lessons learned from recent humanitarian disasters have pointed to major difficulties in establishing portable communication systems in order to quickly and accurately assess the needs in the affected area and communicate this information to first responders from the United States and foreign militaries, government relief agencies and Non-Governmental Organizations (NGOs). Without effective communications and readily accessible information systems, the entire relief effort becomes even more problematic for first responders.

The quality and timeliness of information shapes the effectiveness of emergency response efforts (Horan & Schooley, 2007). Unfortunately, the recurring theme in post-crisis emergency response evaluations of first responders suggest that many disaster management systems often fall short of the capability to deal with the complex and uncertain environment typically encountered. Individual organizations have designed assessment processes and information systems that are focused on intra-organizational information flow. Therefore, these systems are not capable of adapting to the rapidly evolving and fluid environment of disaster scenarios. Improving the initial assessment process also entails improving the manner in which first responder organizations collaborate and coordinate efforts during the relief mission.

B. PROBLEM STATEMENT

The United States military has placed an increasing emphasis on publicizing the importance it is placing on participation in Humanitarian Assistance/Disaster Relief (HA/DR) missions. Therefore, it is imperative that military first responders work with partner relief groups to improve the current assessment and relief processes. The problem is that the current assessment and disaster relief response processes are generally ineffective due to the inherent mistrust between responding organizations and the lack of

experience those organizations have in working with each other in a chaotic and time-pressed environment. One of the areas where this ineffectiveness is highlighted is in conducting initial assessments of the impact that natural disaster have on the Information and Communications Technology (ICT) infrastructure. ICT is an area that directly impacts every other portion of overall relief efforts, yet up to this point no inter-organizational or international entity exists to conduct this crucial assessment post-disaster and share this critical component of information with other first responders in the International Humanitarian Community (IHC).

C. PURPOSE STATEMENT

The purpose of this thesis is to analyze the current assessment processes utilized by responders in HA/DR missions and investigate if Netted Humanitarian responders that receive specialized training in the operation and employment of Hastily Formed Networks (HFN) communication equipment can improve the process of assessing the ICT situation immediately following a natural disaster or human catastrophe. Additionally, this research explores the possibility of employing Netted Humanitarians in the construct of multi-organizational and multi-national Rapid Technology Assessment Teams (RTAT). This research delves into the possibility that these highly trained teams of Netted Humanitarians will expedite overcoming the communications vacuum that immediately follows a natural disaster, and will be beneficial in coordinating the combined recovery efforts of the host nation, NGOs, International Governmental Organizations (IGOs) and other United States government (USG) agencies.

D. OBJECTIVES

The process improvement advocated by this thesis deals primarily with improving the ICT assessment process for responding to disasters. A primary assumption is that the current emergency response infrastructure is already well established and effective in dealing with routine emergencies. Thus, this thesis focuses primarily on improving the ICT assessment capabilities of first responders when faced with a crisis emergency of such a magnitude that the existing capabilities and resources are ineffective for beginning the relief process. The author looked specifically at establishing a rapidly

deployable communications infrastructure in the immediate aftermath of a disaster (within 12–24 hours) that will be comprised of first responders with technical and operational background in establishing the beginning stages of a Hastily Formed Network (HFN).

This thesis not only proposes a solution for improving the effectiveness of the current ICT assessment process, but to also improve the efficiency of the assessment process. With the uncertainty of the current financial situation in the United States and other nations around the globe, resources in HA/DR missions are limited and cannot afford to be wasted due to duplication of effort as a result of failing to integrate the recovery efforts of the IHC. As a result of the limited availability of resources, it is important that human and financial assets are utilized in a sustainable manner that still accomplishes the mission of bringing relief to the affected population. Collaboration, integration and deeper cooperation between responding agencies is essential to making this goal a reality. The concepts of RTAT and the Netted Humanitarian were designed with this reality in mind.

E. BENEFITS OF THE STUDY

The primary potential benefit from this research is the proposed inclusion of the robust communication capabilities of Netted Humanitarians within the construct of the RTAT program. The RTAT program was initially an Office of the Secretary of Defense (OSD) funded program from 2010 to 2012. The primary purpose for establishing RTAT was to create a much needed mechanism for conducting a rapid assessment of the ICT status that would enable the host nation and the IHC to provide a targeted allocation of resources that would result in a reduction of gaps and duplication of effort (Steckler, 2012). Additionally, conduct of this assessment would positively affect other facets of the disaster response effort by providing a current and constantly updated Common Operating Picture (COP), resulting in greater efficiency and effectiveness of relief efforts. The COP would in turn allow for better cooperation and collaboration between responding agencies, which would result in additional costs savings. The RTAT program also seeks to provide a pool of multi-disciplinary experts who are capable of rapidly

deploying to a disaster zone (Steckler, 2012). Given the multi-organizational and multi-national make-up of the Netted Humanitarians that would comprise RTAT, another potential benefit of this study is the quicker establishment of trust between responding agencies, which will lead to a greater willingness to share information. Additionally, the inclusion of data fusion software promises to more easily allow decision makers to ask the questions they need answered vice having to filter through mountains of data from multiple disparate sources.

F. DEFINITIONS

Bandwidth	The transmission range of an electronic communications device or system; the speed of data transfer.
BGAN	Broadband Global Area Network terminal, which is a satellite earth terminal owned and operated by the company InMarsat.
Command and Control	The means by which a commander recognizes what needs to be done and sees to it that appropriate actions are taken.
Communication	This is the act or process of communicating by any means of communication.
COP	A Common Operating Picture is a single identical display of relevant information shared by more than one command. A COP facilitates collaborative planning and assists all echelons to achieve situational awareness.
Data Fusion	Data fusion is the process of integrating multiple data and knowledge sources representing the same real-world object into a single consistent, accurate, and useful representation.
Data Transfer	Copying or moving data from one place to another, typically via some form of network.
First Responder	A certified, often volunteer, emergency, medical, law enforcement officer or military member who is first to arrive at an accident or disaster scene.
Form Factor	The physical size and shape of a device.

HA/DR	Humanitarian Assistance/Disaster Relief is a mission that is deployed to a disaster zone.
Hotspot	A hotspot is a site that offers Internet access over a wireless local area network using a router connected to a link to an Internet service provider. Hotspots typically use Wi-Fi technology.
ICT	Information and Communication Technology. Refers to technologies that provide access to information through telecommunications. It is similar to Information Technology (IT), but focuses primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication mediums.
Infrastructure	Encompasses the basic and underlying framework of features of a system or organization.
Netted Humanitarian	An individual member of a Rapid Technology Assessment Team who is a subject matter expert in the operation of various types of portable communications equipment and disaster relief. They are designed to rapidly deploy to a disaster zone with only the portable communications equipment they are able to carry on themselves to conduct ICT assessments.
RTAT	Rapid Technology Assessment Team is an assessment team comprised of Netted Humanitarians that is deployable within 12–24 hours of a disaster taking place. The mission of RTAT is to conduct an early assessment of the impact the disaster had on the ICT infrastructure of the affected area.
Software	The programs used to direct he operation of a computer, As well as documentation giving instructions on how to Use them.
VSAT	Very Small Aperture Satellite Terminal. Comprising many different earth terminals that vary in size, power and overall capabilities.
Wi-Fi	A local area network that uses high frequency radio signals to transmit and receive data over distances of a few hundred feet; utilizes Ethernet protocol.

G. THESIS STRUCTURE

This thesis is organized in the following fashion:

Chapter I provides for the introduction and overview of this thesis.

Chapter II discusses what a Hastily Formed Network is and some of the challenges faced by participants in this type of network.

Chapter III describes the current disaster response process and discusses how the concept of the Netted Humanitarian could improve the process.

Chapter IV discusses implementation of Netted Humanitarians with Rapid Technology Assessment Teams and provides examples of how they could improve the current disaster response process.

Chapter V summarizes the recommendations of this thesis and provides recommendations for future research.

II. HASTILY FORMED NETWORKS

In general terms, a Hastily Formed Network is a portable and rapidly deployable communications system that allows first responders to communicate, share information, coordinate relief efforts and attain situational awareness after a natural disaster occurs. They are composed of individuals from a broad variety of organizations and geographic locations that have come together in order to bring relief to a disaster-stricken area. The HFN becomes the medium, or "conversation space" through which first responders pool their knowledge and interpretations of the situation, understand what resources are available to them, assess options, plan responses, decide, commit, act, and coordinate (Denning, 2006). Lessons learned from recent disasters repeatedly show that the effectiveness of the response was due in large part to the quality of the network that was able to come together to respond to the crisis. Specifically, how well were the various responding organizations able to collaborate to restore voice and data communications in order to effectively and efficiently provide assistance to victims of the disaster?

> All HFNs share five essential elements. It is a (1) "a network of people established rapidly (2) from different communities, (3) working together in a shared conversation space (4) in which they plan, commit to, and execute actions, to (5) fulfill a large, urgent mission." It is important to note that while the networking technology is vital to reestablishing communications and ultimately the success of relief efforts, the overall success of a Hastily Formed Network depends as much if not more on the people that are a part of the network as the communications hardware itself. (Denning, 2006)

A. RELEVANCY TO MILITARY PROFESSIONALS

This topic is especially relevant in today's military environment when one considers the military's growing role in HA/DR missions. The South East Asia tsunami, Hurricane Katrina, the Haiti earthquake, the earthquake in Japan, and Hurricane Sandy are all examples of recent global disasters in which the United States military played a large role in providing humanitarian aid and relief. This is likely to be an area of focus for the U.S. Armed Forces for the foreseeable future. The U.S. Navy's latest television ads, proclaiming it "A Global Force for Good," are an example of this trend. Part of the

Navy's recruiting campaign explicitly details how the Navy stands ready to answer the need for humanitarian assistance and disaster relief anywhere and anytime. With such an emphasis on making this an important mission area for our military, it is critical for military professionals, and especially future leaders, to understand the role their service, unit, or they themselves might play in HA/DR missions. To illustrate this point, when Hurricane Irene threatened the entire East Coast of the United States in August 2011, 27 naval warships were ordered to get underway from Norfolk Naval Station in an effort to avoid the oncoming storm, including the USS Wasp (LHD-1). However, in addition to avoiding Hurricane Irene, the Wasp was prepared to carry out a much different mission. If called upon, Wasp was prepared to provide state and civilian authorities humanitarian assistance through a variety of services to deal with the aftermath of the storm. In addition to providing medical facilities and utilizing its helicopters for delivering aid and search and rescue missions, the Wasp could also have used its communications suite to act as a communications link to the world outside the affected area.

In response to the havoc that Hurricane Sandy caused in the northeastern United States in October 2012, the Navy sent three large deck amphibious ships off the waters of New York and New Jersey to prepare to provide assistance if called upon to do so. Additionally, the Pentagon mobilized over 10,000 Army and Air Force National Guard personnel to provide support to the 13 states most heavily impacted by Hurricane Sandy.

The aforementioned examples are just some of the reasons that make training specialized military personnel with the skill set required to set up Hastily Formed Networks a critical requirement. This training should not focus solely on learning the technical aspects involved with understanding how to set up, operate and maintain the gear, but also must include lessons learned and best practices for coordinating with other relief organizations.

Hastily Formed Networks provide a much needed service to the region affected by a natural disaster. Without emergency communications, coordinating with other first responders becomes nearly impossible. This presents a great challenge to successfully providing aid where it is most needed and in minimizing duplicity of effort. A key characteristic of HFNs is their ability to utilize Commercial Off-the-Shelf (COTS)

wireless equipment, such as satellite communication, Wi-Fi and Worldwide Interoperability for Microwave Access (WiMAX), in order to provide communication for regions affected by natural or man-made disasters. Additionally, and probably most importantly, the equipment is designed to be relatively simple to operate and portable (Lim & Ng, 2007).

Another key attribute of a successful HFN is its level of self-sufficiency. The Naval Postgraduate School's Hastily Formed Networks Research Group is a model for self-sufficiency. The school's HFN team is structured in a specific manner for deploying to regions affected by natural disasters of a large magnitude. The team deployed to Haiti in response to the powerful earthquake that left much of the country in ruins, bringing with it hard-cased "fly away kits" with the group's communications equipment. Also included in the kits was critical material that allowed the team to be self-contained. According to the Director of NPS's HFN group, the team brings with it "everything we'd need if deployed on the ground – portable light-weight tents, sleeping bags, meals ready to eat, water purification and filtration equipment, alternate power, cooking equipment, various communications devices, you name it" (Honegger, 2010).

Specialized communications gear can be used by an HFN team to set up Internet access capabilities, which in turn enables voice/chat (Skype), video, email and data communications via satellite. Broadband Global Area Network satellite units (BGANs) allow HFN responders to connect to the Internet via the International Maritime Satellite Network within five minutes. BGANs are also capable of generating 100-meter wireless "clouds." These clouds can then be connected to one another using WiMAX terrestrial long- haul wireless point-to-point networks that can extend up to 30 miles, bringing links from one site to another in point-to-point mode or with multiple hops. Wi-Fi clouds can create temporary Internet "cafes" in hospitals or field clinics, boat or helicopter landing zones, and key relief sites. Additionally, GPS devices and visualization systems are utilized to provide command and control situational awareness. Using tools such as Command and Control Personal Computer (C2PC) to develop, share and edit a COP is mission critical when dealing with a humanitarian disaster. In an HA/DR mission, first responders are often spread out over a wide area and the ability to communicate with one

another is often challenging. Even something as simple as a satellite phone can provide critical information sharing capabilities (Honegger, 2010).

An HFN is much more than just the communications system itself. If the people that form the backbone of the network are unwilling or unable to trust each other, the relief efforts will become much more difficult. When multiple organizations respond to a crisis or disaster, they bring with them their own way of conducting business as well as their own cultural, organizational, and legal norms. Unlike organizations dealing with each other in a civil and stable environment, these organizations are attempting to coordinate in an uncertain and chaotic environment, which only adds to the level of mistrust (Janssen, 2010). Furthermore, each organization brings with it organizational biases and social habits. In particular, organizational social identity bias can be a major impediment to collaboration. Organization social identity creates an environment where information is shared within the organization but not outside the group. Studies have shown that when group members are under stress, they do not think to collaborate or share information with those outside the boundaries of their organization, and have no incentive to worry about the welfare of other groups (Denning, 2006).

B. LACK OF TRUST

Adding to this problem is the inherent lack of trust between specific organizations. Traditionally, the military and Non-Governmental Organizations (NGOs) have experienced a lack of understanding and appreciation for the roles of the other in an HA/DR mission. Differences in culture and command structure inevitably lead to mistrust. NGOs tend to see the military’s organizational structure as too rigid and inflexible and overly authoritative in nature. In contrast, NGOs tend to be much less structured, relying to a greater extent on establishing inter-personal relationships to accomplish their goals. Furthermore, a general lack of experience working together in coordinated disaster exercises or real-world disaster relief tends to create an even larger barrier to building trust and establishing an effective HFN (Wentz, 2006).

Trust can be defined as the point when the one party has a fundamental belief that the other can be relied upon to fulfill their obligations with integrity, and will act in the

best interests of the other (Tatham & Kovacs, 2010). It is important to note that this definition of trust focuses on inter-personal, rather than intra- or inter-organizational relationships. It is argued that decisions within organizations are made by individuals and, therefore, the level of intra/inter-organizational trust can be seen as a reflection of those individual relationships—although it is recognized that, in reality, the spectrum of possible and actual relationships is significantly more complex. Of high importance to building stronger working relationships in an HA/DR environment is developing what Peter Tatham coins in his article Developing and Maintaining Trust in Post-disaster Hastily Formed Networks, as “Swift Trust.” Swift trust is the preferred route to developing trust in an HA/DR mission, due to the need to quickly establish trusting inter-personal relationships in a very short period of time (Tatham & Kovacs, 2010). The five antecedent conditions to developing swift trust are:

- Role—trust is assumed based on the role a person holds in an organization. For example, logisticians in an HA/DR are trusted to be experts in logistics.
- Third party information—trust is developed based on third parties opinions based on reputation and prior experience working with that particular individual.
- Category—trust is dependent on membership of individuals in social groups or categories. Difficulties between NGOs and the military often correspond to perceived differences in goals and organizational stereotypes.
- Rule—trust is based on following the rules of an organization, therefore, an individual is deemed trustworthy if they follow the rules.
- Disposition—trust is dependent on the general disposition of an individual to trust other people. Some people are just inherently more trusting of others.

C. INFORMATION SHARING

When trust between responding organizations is not present, the sharing of vital information also becomes a scarce commodity. As a result, relief efforts are often duplicated by the various organizations as there is little to no communication flow between the responders. This lack of coordination creates a waste of effort, wasted manpower, and handicaps relief efforts by not maximizing available resources. Since

large incidents involve a large number of agencies, command structures that are unclear, often conflicting, uncooperative, and isolated, tend to exacerbate the problem of sharing information (Donahue & Tuohy, 2006).

Although the vast majority of relief organizations agree that information sharing is critical to the success of their particular organization and the entire effort as a whole, the problem persists. When dealing with information within and outside distinct organizations, information is considered an important asset that must be produced, retrieved, processed, validated and distributed between organizations (Bharosa, Lee, & Janssen, 2010). Yet again, despite the obvious benefits of sharing information between first responders, and despite having the conversation space in the form of the Hastily Formed Network available, organizations still do a woeful job of sharing invaluable and possibly life-saving information. Organizations become focused on sharing information within their organizational boundaries while ignoring or being unaware of other responding groups and collaborating toward common goals. This tendency creates organizational information silos that provide little incentive to move toward a model that values horizontal information sharing.

With regard to the information flow among first responders, timing is everything. If information is received too late, it may fail to prevent damages or losses, while if it is too early, it may be neglected. Additionally, too much information, known as information glut, can overload responders' ability to process and utilize the information in a timely manner.

D. INTEROPERABILITY

Even when organizations have developed the level of trust required to share information freely during an HA/DR mission, problems with interoperability often derail effective information flow. Much of this lack of interoperability can be attributed to the use of a wide variety of communications systems hardware and software. Each responding organization brings with it its specific capabilities and communications equipment, which works wonderfully within the spectrum of the organization's network, but fails to be interoperable when coordinating with other organizations that also

constitute the HFN. An example of this would be a certain organization using a Windows based system, while another might use a Linux based system. The existence of isolated, highly fragmented and unrelated computer applications within individual organizations has resulted in major interoperability issues and has led to the creation of “isolated islands of technology” in information systems (Janssen, 2010).

However, problems with interoperability are not solely a result of incompatible communications equipment. Often the greater problem evolves from the unique policies and procedures of individual organizations which make the process of collaborating with other organizations exceedingly difficult. Even a capability as seemingly routine as accessing web-based email accounts can create numerous difficulties when doing so using another entity’s network, especially in the time pressed world of HA/DR. A Department of Defense (DoD) report by the department’s Chief Information Officer claimed that policies and procedures in place frustrated efforts to share information across the civil-military boundary during the military’s response to the devastating December 2004 South East Asia Tsunami (Brewin, 2005). Security policies in place prevented employees from the United Nations, other NGOs, and the U.S. Agency for International Development (USAID), from being able to communicate using the USS Abraham Lincoln’s network. Despite having a robust communications suite that included wideband satellite links, the civilians embarked onboard the Abraham Lincoln were prevented from accessing simple web based email services (Brewin, 2005). These same civilian employees were also prevented from attending the ship’s daily unclassified briefings regarding the relief efforts, again preventing them from being able to more easily coordinate and share information to better assist the relief efforts.

During the combined response to Hurricane Katrina, despite the fact that Federal, State, and local agencies had communications plans and assets in place, the plans and the assets involved were inadequate and not effectively integrated to respond to the disaster (DHS, 2006). Moreover, many of the assets available were not properly utilized in the effort because no national, state, or regional communications plan was in place to incorporate them. Without a doubt, the inability to connect the various communications plans and architectures greatly impeded coordination and communication at the Federal,

State, and local level (DHS, 2006). Open architecture and flexibility are key components to future communications technology in HA/DR environments (Boland, 2006).

All these examples of past failures and shortcomings regarding interoperability point to a real issue by responding agencies in formulating a cohesive Enterprise Architecture (EA). The EA defines and inter-relates data, hardware, software, and communications resources, as well as the supporting organization required to maintain the overall physical structure required by the architecture (Janssen, 2010). EA can be utilized as a tool for effective decision making and the development of a more interoperable information system. Granted, EAs in disaster response are by necessity general and basic in nature. This allows them to be more easily adapted by a wider range of responding organizations. While a necessary trait, this makes the EA more rigid and less adaptable to the unique characteristics involved with crisis management. Stakeholders need to collaborate and strive for an EA that is more adaptable to quickly developing situations and is easily understood by participants. This necessitates the creation of a shared vision, improved communication among stakeholders and critical evaluation of the impact the shared EA will have on the HFN and its response processes.

E. COMMAND AND CONTROL

Dr. Peter J. Denning, Director of the Cebrowski Institute for Innovation and Information Superiority at the Naval Postgraduate School further defines Hastily Formed Networks as “an organizational structure that is (a) put together quickly in response to an emergency, crisis, or urgent situation, (b) for a collection of entities who have expertise or local responsibility to help but have not worked together before, (c) and who accept no higher decision-making authority” (Denning & Hayes-Roth, 2006). The last portion of the definition is likely to be particularly troubling to most military organizations, as it goes against the military ethos and is contrary to the traditional military hierarchical command and control structure.

While the hierarchical command structure certainly has its place in organizations such as the military, Dr. Denning argues that they are not effective in what he coins “hyper-networks.” Denning defined a hyper-network as “federated activities toward

common goals among multiple organizations that retain their separate identities and have no common hierarchy" (Denning & Hayes-Roth, 2006). This is an extremely accurate description of what transpires in an HA/DR. To further complicate efforts, the HFN does not have the benefit of having much time to adapt and learn before it is expected to produce results. For these reasons, Dr. Denning determined that a decentralized decision making structure is the most effective in creating a successful HFN.

F. LACK OF KNOWLEDGE BY RESPONDERS

Another persistent problem that continues to be identified in "hot washes," After Action Reports, and Lessons Learned documents is the relative lack of knowledge most responders have in understanding basic systems for disaster response. With regard to disasters in the United States, in addition to the National Response Plan (NRP) and the National Response Framework (NRF) that replaced it after Hurricane Katrina, the two primary systems involved are Incident Command System (ICS) and the National Incident Management System (NIMS).

Many difficult lessons were learned during the often criticized federal response to the disaster wrought by Hurricane Katrina to the Gulf Coast region of the United States. Among them was the fact that key decision-makers at all levels simply were not familiar with the plans. When Hurricane Katrina struck, the NRP was not well understood by most officials involved in the response, and thus this lack of knowledge resulted in ineffective coordination of the Federal, State, and local response (DHS, 2006). Furthermore, the NRP itself was only intended to be a base plan that outlined the overall elements of a response. Federal departments and agencies were supposed to create their own individual operational plans and standard operating procedures (SOPs) in order to integrate their response plans into the national response plan. It later came to light that this had not taken place at all or was still in progress at most of the federal departments and agencies involved. Furthermore, the majority of deployed Federal personnel lacked a working knowledge of NIMS or even a basic understanding of ICS principles. This resulted in valuable time and resources being devoted to provide on the-job ICS training to Federal personnel, rather than dedicating those resources to relief efforts (DHS, 2006).

G. APPLYING LESSONS LEARNED

Compiling a list of lessons learned after an evolution, exercise, or large-scale event is commonplace in the military realm. Military organizations go to great lengths to annotate, publish and distribute this information to their forces. Similar requirements for compiling lessons learned exist in the vast majority of civilian organizations. Despite this fact, applying those lessons learned in HA/DR seems to continue to evade first responders. Hastily Formed Networks are no exception to this trend. Lessons Learned from previous HA/DR missions should be used to drive new and improved policy, the generation of HFN and HA/DR concepts of operation, and perhaps most importantly solve the non-technical, social and civil-military issues that are all too common in recent large-scale disasters (Steckler, Bradford, & Urrea, 2005). Applying these lessons will go a long way toward changing perceptions and supporting DoD policy that acknowledges that military-civilian teams are a critical U.S. government stability operations tool (DoD, 2009).

H. LACK OF COORDINATED EXERCISES

Lessons learned from recent disasters have documented that a lack of coordinated multi-organizational exercises detracts from the effectiveness of response efforts. Furthermore, interagency training and rehearsal is absolutely fundamental to real disaster preparedness (DHS, 2006). The leadership of organizations that respond to HA/DR missions must better understand the urgent need to conduct exercises in order to train their responders to deal with the inherent difficult involved in HA/DR, in order to get on with the goal of saving lives.

However, just conducting exercises is not enough to prepare responders to operate in an HA/DR environment. The right balance between the known and unknown must be struck in order to prepare for events that are likely to happen as well as those that are unforeseen. Furthermore, those that develop these exercises should be free to be imaginative in designing scenarios that will test the responders, without being so far-fetched that they are a waste of time. Exercises must be realistic and not overly simplistic (Donahue & Tuohy, 2006). Finally, these exercises should be designed to be difficult,

and if the right steps are not taken by responders, then failure of the exercise is a possible outcome. However, the participants should not be afraid to fail, as long as they are learning from their mistakes. There should be no punitive action other than conducting more training in order to pass the exercise scenario. This will further prepare exercise participants to deal with the inevitable setbacks that are bound to occur in a real-world HA/DR mission.

I. PROPOSAL FOR THE WAY AHEAD

One can clearly deduce from the previous sections that attaining effective collaboration between first responders in a HFN is exceptionally difficult. Despite having the same goals and desires to help the people affected by a disaster, often times first responders find themselves increasingly frustrated by efforts to coordinate with one another and conduct an effective and efficient multi-agency disaster response.

The general consensus in the crisis response community is that enabling shared access to information among autonomous relief agencies is the main bottleneck when it comes to effective inter-agency crisis response. Improvements in the area of information sharing, coordination and collaboration are crucial due to the fact that access to core information by first responders inevitably leads to improved effectiveness and efficiencies throughout the network. An inordinately large number of failures and difficulties encountered in the disaster relief missions are directly attributable to poor coordination in the first responder community. This results in issues such as poor allocation of first responder resources, counter-productive ordering of sequential relief processes, and delayed evacuations, all of which serve to exacerbate the crisis and could result in higher casualties (Bharosa et al., 2010).

Multi-agency coordination runs counter to the normal independent operating mode of the individual organizations in non-disaster related situations. However, when disaster strikes and coordination between agencies becomes paramount, complexity often arises from the difficulty in effectively synchronizing a relief effort with the various elements, systems, processes and actors involved. This makes obtaining a clear and reliable picture of the disaster situation exceptionally challenging.

If a successful response to a crisis situation is absolutely dependent on information flowing in a coordinated fashion among multi-agency responders, does it not make sense to implement integrated teams composed of responders from across the disaster relief community? These teams would train together, work under the same standardized response framework, and would already be accustomed to working together in a tightly organized fashion prior to the disaster. We know that coordination and sharing of information revolves around the varying organizational operational structures. Some organizations, like the military, are hierarchical in structure and tend to be more authoritative when making decisions. Others are much more informal and horizontally structured, which leads to a more democratic approach to decision making. The internal cultures and mode of operation of the individual organizations lead to distinct and tailored roles, procedures and capabilities designed to deal with a crisis situation. This becomes a challenge when organizations are expected to coordinate, collaborate, and become interoperable with one another. Formulating teams of experts from across the disaster relief community could help alleviate many of these concerns.

This thesis researches the possibility of creating multi-organizational Netted Humanitarians that would operate within the framework of a Rapid Technology Assessment Team (RTAT). Netted Humanitarians, as part of an RTAT, would serve a crucial purpose by improving coordination and cooperation in the early stages of a disaster relief mission. Cooperation between responding agencies falls into three categories:

- Coordination of services, essentially who will be where doing what
- Distribution of resources, in other words ensuring that the required medicine, supplies and equipment reach those who need it, when they need it
- Orchestration of controls, to include quarantines, evacuations, or movement of population subgroups.

All of these areas are dependent on timely, accurate information. Transfer of information between people that lack day-to-day partnerships become particularly important when large numbers of volunteers or donations are involved. To make this happen requires effective collaboration, good organization, clear leadership, and sensible

preparation (Gibbons, 2007). This is where the concepts of the Netted Humanitarian and RTAT could play a key and pivotal role. Through rapid deployment in the first 12 to 24hours, the Netted Humanitarians of the RTAT would be able to set up rapid portable communications and begin the critical initial Information Technology (IT) assessment of the disaster. One way to think of RTAT is as the advanced survey team prior to the arrival of first responders. Information and Communication Technology (ICT) and power sectors are critical to the response after major disasters. A rapid assessment of the ICT status will enable the host nation and the IHC to provide a targeted allocation of resources and will result in a reduction of gaps and duplication of effort. The vision for RTAT is to pave the way through a rapid yet structured initial assessment process, with the primary goal of assessing ICT needs and establishing the magnitude of the disaster in order for follow-on responding agencies to orchestrate relief efforts more effectively and efficiently. This would be conducted through the use of highly portable communications equipment in fly-away kits capable of being carried by highly mobile Netted Humanitarians. The following chapter provides greater detail into the concepts of the Netted Humanitarian and RTAT.

THIS PAGE INTENTIONALLY LEFT BLANK

III. DISASTER RESPONSE PROCESS AND THE NETTED HUMANITARIAN

A. ROUTINE VS. CRISIS EMERGENCIES

There is an important distinction routine and crisis emergencies. When a particular type of emergency happens between sufficiently frequently in an area where people have (or should have) resources to organize and prepare, it becomes a routine event. Examples of a routine emergency include a fire in an area where fires are common and there exists a proficient and well-resourced fire department, a moderate earthquake in an area predisposed to earthquakes and where the emergency services are accustomed and prepared to deal with the situation, or a hurricane in an hurricane zone where the public and public officials know how to prepare and are accustomed to preparing and responding to the event. No doubt these are all disastrous events. However, the expertise and knowledge on how to manage these situations is present, resources to do so are available and emergency actions are practiced and well understood. Categorizing a disaster as routine or crisis is highly dependent on the scope of the disaster. Clearly the Southeast Asia Tsunami, Hurricane Katrina, the Haiti Earthquake are examples where the scope of the problem exceeded the ability of the existing emergency response infrastructure, available resources, and invalidated standard responses (Gibbons, 2007). These disasters are more accurately categorized as crisis emergencies.

In routine emergencies there exists a high level of understanding with regard to dealing with the emergency. Therefore, there are well-engineered scripts, highly defined skill sets, knowledgeable leaders and a well-established hierarchical command structure. By contrast, crisis emergencies rely on fluid response procedures with little scripting, unspecified skill sets, a more collaborative environment and less hierarchical command structure (Gibbons, 2007). In short, the response organization needs to be more agile and better prepared to deal effectively with quickly developing scenarios as they arise. Furthermore, they must be able to customize and improvise on short notice and in response to the evolving situation. Since the situation does not fit into the “norm” of routine emergencies, hierarchical leadership is not effective and first responders have no

choice but to work together in a collaborative environment and methodically work through discovering solutions to the emerging situation. While this is the reality faced by first responders in crisis emergencies, it is easier said than applied in real-world situations. The inherent mistrust between responding agencies, typically poor communications infrastructure and general chaos, combined with the general lack of understanding of how partner organizations operate, results in poor cooperation, inadequate sharing of information and ineffective coordination.

B. APPLYING ROUTINE EMERGENCY PRINCIPLES TO CRISIS EMERGENCIES

Many of the tragedies that have resulted from natural or man-made disasters can be categorized as recurrent, in other words, they are unpredictable in detail, but highly predictable in general pattern. Society has adapted to these predictable patterns and responded to these types of emergencies and catastrophes by instituting mitigating measures such as police departments, fire departments, emergency medical services, search and rescue, as well as disaster relief organizations, both private and governmental (Gibbons, 2007) . Establishment of these organizations arose from an identified need to better prepare to deal with these situations that history had taught society were inevitable. The same logic can be applied when preparing and responding to crisis emergencies. History has taught us, in the form of numerous disasters, that cooperation, coordination and collaboration between relief organizations is exceptionally difficult. Countless lessons learned from recent disasters have been written about the trials and tribulations faced by first responders. Nearly all of them describe similar difficulties in trying to respond to the disaster in a highly chaotic environment.

Setting up reliable portable communications in this type of scenario is no different. Despite this knowledge, setting up communications after a disaster continues to be painfully difficult and erratic. The first responder community is well aware of the barriers to success that are present when disparate relief organizations come together to provide support. Every single relief organization is organized in a specific and unique manner that reflects the vision, goals and culture of that particular organization. The standard operating procedures are normally well known throughout that organization,

down to the specific relief individuals in the field. Furthermore, each organization utilizes its own procedures, protocol and technical equipment for communicating with their first responders. However, as we are well aware, responding to disasters requires trust, coordination and collaboration between those responding.

In order to overcome the ever present roadblocks to effectively responding to crisis emergencies, perhaps we need to take a page from the steps society took to deal with routine emergencies. If the same difficulties are encountered in ensuing crisis emergencies, then relief agencies should be proactive in resolving the issues before the next disaster strikes. Therefore, the creation and employment of rapidly deployable and multi-agency manned portable communications teams could go a long way toward improving the assessment capability of the first responders. It would begin the crucial task of laying the communications foundation for follow-on relief resources. In a manner akin to Urban Search and Rescue, the proposed RTAT could be trained in the operation of the equipment and in overcoming the difficulties inherent in assessing ICT status and establishing portable communications in a quickly developing and complex environment.

C. CURRENT STATUS OF THE POST DISASTER ASSESSMENT PROCESS

The existing capabilities of the international humanitarian community to conduct post disaster assessment of ICT is very limited and disjointed. While some organizations have teams that are capable of deploying within 12–24 hours, their ICT assessment capabilities are very rudimentary. The primary reason for this is the fact that the majority of existing post disaster assessments focus on areas other than ICT, power and information sharing. The United Nations Disaster Assessment and Coordination (UNDAC), the Emergency Telecommunications Cluster (ETC) and the International Federation of the Red Cross/Red Crescent (IFRC) First Assessment and Coordination Teams (FACT) are all examples of existing disaster assessment teams. While each provides some assessment capability, their focus is primarily on sector specialty areas other than ICT and information sharing. Unfortunately, the IHC has been slow to realize the importance of the ICT sector as all other sectors in disaster relief are supported and enabled by it to some extent.

Difficulties in ICT are actually exacerbated by the arrival of the global response community. Their arrival provides a welcome and powerful ICT capacity; however, their ICT equipment and capabilities do not normally link effectively with the ICT of the host nation or each other. Inevitably, this leads to gaps and duplication of effort in the recovery process and poor distribution of available resources. The arrival of the global response community is not the only problem encountered in the early stages of the post disaster assessment effort. Often times the host nation has not initially requested assistance from the international community and has internally managed specific requests for assistance from the population. With the host nation's government struggling to provide a semblance of order in the midst of chaos its resources are often stretched to the breaking point and it is unable to accurately assess ICT and power needs for the affected area. Not having a complete picture of the status of the ICT in the disaster zone results in a knowledge gap regarding the status of the ICT infrastructure and a lack of communication between the IHC and the host nation's national infrastructure.

With the affected nation and numerous international organizations each utilizing their own processes and assessment methods in an effort to accurately depict the situation and develop relief priorities, it is incredibly difficult to begin a coordinated approach to establishing a common situational overview of the ICT infrastructure. With numerous situational awareness tools and databases in use by different members of the IHC, it is nearly impossible to develop a Common Operating Picture (COP) that accurately and completely describes the situation in real-time. Therefore, the first responders must attempt the tedious and time-consuming task of compiling a COP from a hodgepodge of sources that are not capable of communicating with each other and utilize different semantics, ontologies, data definitions and processes.

D. IMPROVING THE POST DISASTER ASSESSMENT PROCESS

It has already been established that any single agency conducting a comprehensive assessment of the ICT situation is likely to fail due to a lack of resources and capability. Furthermore, conducting limited individual ICT assessments does not solve the issues of lack of interoperability and poor information sharing between

members of the IHC inherent in the current process. The RTAT concept seeks to provide a pool of multi-disciplinary experts who will rapidly deploy to the disaster zone to conduct the crucial task of assessing the status of the ICT in order to provide the host nation and the IHC with the latest information to quickly begin the recovery process. Assessing the ICT status is critical to obtaining targeted support that will enable rapid response, business recovery, and minimize the effects of the disaster on the affected population.

The RTAT concept aims to achieve this through the creation of small, nimble, multi-organizational, multi-national integrated assessment teams of specialists in key ICT areas such as wireless data communications, voice communications, radio technologies, power, information sharing and social networking among others (Steckler, 2012). A key benefit to this proposed program is the membership make-up of the teams. The teams would consist of experts from a variety of different organizations that include industry, UN, NGOs, academia, International Organizations, host nation government/military, as well as international governments/militaries. Having this multi-organizational and multi-national flavor to the teams will go a long way toward overcoming many of the difficulties encountered by the responding organizations in sharing information, collaborating and coordinating a unified response. Melding these experts with various backgrounds into a cohesive team with a very specific mission will allow for better understanding of how the individual organizations communicate and of the processes they utilize when responding to disasters. The desire is for this understanding to eventually lead to an increase in trust between the organizations of the IHC. With increased trust come improved information sharing, better collaboration and stronger cooperation, all of which lead to a more effective and efficient response effort. Working together in a small tight knit group will allow the individual RTAT members, also known as Netted Humanitarians, to act as informed liaisons to their parent organization. The benefits of building better relationships and increasing trust and understanding between members of the IHC cannot be understated.

The primary goal of the RTAT is to establish a comprehensive overview of the ICT situation in the disaster zone and then develop a prioritized list of ICT needs

(Steckler, 2012). This list will be developed in coordination with the host nation. In the event that the host nation has not requested international assistance, it would be possible for the host nation to request the RTAT to provide specific and limited ICT disaster assessments. The teams will gather field data regarding communications technology and power needs that can be utilized by the host nation in its recovery efforts as well as by the IHC once/if those resources are mobilized. The gathered information can then be assessed for quality and usefulness by the experts on the team in order to prepare reliable and trusted information to follow-on responders from the IHC. By concentrating on the importance of human interfaces in collaboration, the Netted Humanitarians of RTAT will work to identify and find solutions to specific questions by compiling a common operational picture in order to link with the host nation and the IHC to enable an expeditious and effective recovery effort. The need to improve the current disaster response process is recognized by the response community. However, the need has not been adequately addressed. Creation and implementation of the RTAT concept is a proposal to address this need and the shortcomings of the practices of the current process.

E. TEAM MAKEUP AND REQUIREMENTS

The RTAT would ideally consist of 1–2 Netted Humanitarian representatives from each of the following types of organizations: UN, NGOs, IGOs, academia, industry, military and government agencies from around the world. In addition to being technically savvy in the operation of portable communications equipment, having experience in conducting interagency operations is a huge plus. This experience is crucial in order to allow for improved collaboration on action plans and coordination of their execution. Furthermore, the Netted Humanitarian needs to be skilled in the art of improvisation and experience in leading a decentralized social network with little to no hierarchical chain of command. The RTAT would be led by a Team Leader from the global humanitarian response and technical community and a senior member of the affected state, someone equivalent to the Head of the National Disaster Management Agency or the Ministry of Communications. The actual size of the team would be flexible and primarily determined by the scope of the disaster and the capabilities of the host nation in assessing ICT and power needs. Likewise, the skill sets of the Netted Humanitarians on the team would be

determined by the specific requirements of the disaster. The expectation is for the teams to be on stand-by ready to deploy within 12–24 hours, 24 hours a day, 7 days a week, 365 days a year (Steckler, 2012). Furthermore, the likely deployment length would be 1–2 weeks, again dependent on the needs of the affected nation. At this point, another RTAT could be deployed to relieve the initial team.

F. VALUE ADDED TO THE UNITED STATES GOVERNMENT AND THE INTERNATIONAL HUMANITARIAN COMMUNITY

The importance placed by the USG on responding to disasters by conducting HA/DR missions is already well established. It is committed to making HA/DR a primary focus area and an important facet of its National Security Strategy (NSS). Given the invaluable skill set of its servicemembers, rapid deployment capabilities and the enormous material and personnel resources at its disposal, assisting in relief efforts is in many ways a natural fit for the military. However, given the era of fiscal austerity in which the United States finds itself, it is an absolute imperative that the USG utilizes its diminishing resources in a responsible yet effective manner. Most sources estimate that the DoD budget alone will be cut by approximately $450 to $500 billion over the next 10 years (Crenshaw, 2012). Therefore, the USG simply cannot afford to be desultory in its response to future disasters. Additionally, it must develop a better understanding of and develop more intimate relationships with its NGO and IGO partners in the relief effort process. Placing increased emphasis on proactive networking, strategizing, and training before a disaster happens is critical to significantly enhancing the likelihood of a successful response. Integrating design principles for success under dynamic uncertainty with lessons learned from practical experience, responders may obtain guidelines for crisis management systems (Gibbons, 2007).

For the civilian component of the IHC, learning to appreciate and cultivate relationships with military responders is equally important in order to better coordinate and collaborate on the relief efforts. Developing trust and overcoming existing barriers to collaboration is an ongoing process that will require patience and time to flourish. For most NGOs, disaster response is only one component of the services they provide. Therefore, after the onset of disaster many NGOs frequently turn to local, state and

federal entities for coordinating instructions. Some plan their own disaster recovery efforts, operating independently until they find partner through previous experience or at the disaster site (Gibbons, 2007).Without a doubt, nonprofit organizations provide the vast majority of hands-on disaster relief and recovery work. In nearly every disaster relief mission, they are present long after government agencies and the military have left. Despite this fact, the nonprofit organizations rely heavily on the military to provide physical security in dangerous disaster zones and to provide much needed heavy lift and transportation capabilities in the affected area. Without these important capabilities, the relief efforts of the NGO volunteers would be much slower and difficult to conduct. The bottom line is that NGOs and military responders need and rely upon one another to a large extent during a relief mission.

The military maintains a reputation for getting the job done regardless of difficulties faced in any situation. The HA/DR arena is no different. Despite this flexibility, a more structured approach is a dire necessity in order to improve the disaster response process. This approach must combine coordinated systems, procedures and the development of a COP with a supporting framework for improving crisis dialogue, planning and information exchange (Romano, 2011). The USG cannot achieve this by itself; the structured approach must be developed in conjunction with all of its partners in the disaster relief community. In a perfect situation, responses to crisis emergencies should consist of a network of complementary organizations working cooperatively toward shared goals.” (Gibbons, 2007) However, reality is far from this perfect situation. Grasping the gravity of the disaster, ascertaining the relief requirements and properly allocating available resources is always incredibly challenging in an HA/DR mission.

It is this uncertainty and difficulty in collaboratively responding to disasters that Netted Humanitarians and RTAT are designed to address and overcome. For example, while USG HA/DR planners, logisticians and responders are likely to have access to a variety of asset visibility tools, the tools they utilize exclude visibility of assets maintained by other USG agencies and NGOs. This deficiency leads to a lack of coordinated response due to the lack of visibility over available assets and the lack of

understanding of the material distribution plans of individual organizations. The outcome is possible duplication of effort and wasted resources.

Furthermore, much of the collaboration and planning within the military takes place in classified forums, which excludes key interagency and NGO organizations from fully participating and collaborating in the relief efforts. This points to a need to improve information sharing and to develop shared and open tools to better organize, source and deliver relief supplies. Coordination, from previous evidence, occurs most reliably with timely, accurate information search and exchange processes. In short, without open and effective communication, coordination is likely to fail (Gibbons, 2007). Finally, it is critical for the participants in disaster planning and response to include people from all stakeholder groups, including public and private organizations, NGOs, federal and state government agencies, military, as well as community groups. The structure and team makeup of RTAT is specifically designed to address this important requirement. Since the Netted Humanitarians come from a variety of organizations and backgrounds, coordination and information sharing are facilitated, allowing for better collaboration and intelligent use of the aggregate talents and abilities of the team.

Another cog in the coordination and collaboration difficulties encountered by responding organizations are differences in leadership and decision-making structure. Nowhere is this difference more visible and readily apparent than in the coordination efforts between United States military and NGO responders. The military is almost exclusively hierarchically driven, and military members always want to know who is in charge. Military leadership and decision-making is top-down driven, and in most cases rank is the most important attribute in getting anything done. Coordination is also conducted in a very specific procedural manner and is highly linear in nature; for example logisticians will deal only with other logisticians. While military humanitarian responders agree to follow the Chain of Command, NGOs zealously guard their separate identities, cultures and manner of operating. Utilizing a more decentralized decision-making model allows them to work toward the accomplishment of common relief goals without having to give up their separate identities (Denning, 2006).

In the chaotic environment in which HFNs operate, lateral communication and decentralized control among competent responders enables rapid, effective action. On the flip side, hierarchical coordination has a tendency to limit lateral communication, collaborative problem solving and adaptation. Employing decentralized coordination, where all participants in the relief efforts are able to coordinate directly with others, results in more fluid and ongoing access to information from all sources and facilitates collaborative problem solving, resource sharing, innovation, and adaptation. Within an emergency response team, organic system design that incorporates decentralized communications, joint problem solving, and autonomous decision making actually increases performance. When dealing with uncertainty organizations must be flexible and highly adaptable. Lateral communications help first responders know which actions to take and how they can accomplish the most good with the available resources (Gibbons, 2007).

Once disaster strikes, the relief process is absolutely dependent on multiple organizations transforming from autonomous actors into interdependent decision-making teams. Implementing the concept of Netted Humanitarians that operate in multi-organizational teams could go a long way to addressing many of the obstacles faced by first responders. Netted Humanitarians as members of an RTAT are critical to proactive network building, conducting strategic planning, and training first responders to cooperate in a chaotic situation. A network that supports rapid information transfer without overloading individuals with unnecessary information is ideal (Gibbons, 2007). This goal requires a stable infrastructure and trained personnel schooled in the operation of the HFN equipment.

G. TECHNOLOGY AND EQUIPMENT

The following section focuses on outlining some of the currently available communications technology that could be paired with first responders on RTAT in order to carry out the post-disaster assessment. This section does not intend to be an advertisement for any specific product or company. It simply aims to identify and describe some of the technology and gear that is available for use by the Netted

Humanitarian in carrying out their duties. If the concept of RTAT is ever implemented, its success will be highly dependent on having the resources and equipment to accomplish the humanitarian mission and thereby increasing the success of the IHC in conducting post-disaster assessments. This is by no means the be-all end-all list of equipment or technology that can be utilized within the spectrum of RTAT operations. With the rapid pace at which technology is improving it is vitally important to keep abreast of the latest improvements. One of the suggestions for future research on this topic is to continually monitor the technological landscape for innovative and clever ways to combine emerging and existing technologies into a more robust and capable FLAK for Netted Humanitarians. As for the Netted Humanitarians themselves, they must be skilled and knowledgeable in the setup and operation of mobile communication and sensor systems.

1. Satellite Communications (SATCOM)

Lessons learned have taught us that access to reliable communications saves lives and plays a crucial role for disaster victims, first responders, relief workers, and national and local governments (ViaSat, 2012). In areas where wireless and terrestrial infrastructure are unavailable, damaged, or overloaded, satellite communications may be the only viable way to re-establish Internet connectivity communications. Satellite systems offer redundancy and reliability that when effectively leveraged are capable of circumventing the often catastrophic destruction or degradation of the ground-based communications infrastructure of the affected area. Additionally, these satellite communications systems must be portable and simple to operate, and be able to quickly establish a reliable high-speed uplink. Antenna pointing aids for rapid satellite acquisition as well as simple and reliable installation that involves minimal training are highly desirable attributes. Access to real-time, situational information, plus the relaying of photos, video, and assessment of local conditions, provides decision-makers the tools they need to support on-the-ground response and recovery efforts. The temporary infrastructure provides Internet as well as secure VPN data, voice, and video services and can remain in place for days or weeks, as the situation requires (Viasat, 2012). Additionally, the equipment must be ruggedized to support operation in harsh conditions

and needs to support multiple configuration options to suit varying user needs. The complete system, including the satellite terminal and antenna, should be able to be packed into one or two cases for transit and must remain lightweight enough to be airline luggage checkable and carried by a single user.

a. BGAN

Developed by INMARSAT as a secure and reliable satellite communications network with global coverage, the Broadband Global Area Network (BGAN) is ideal for use by the Netted Humanitarian in a HA/DR scenario. Its lightweight form factor, fast connection speeds and the fact that it requires little technical expertise or training to operate make it exceptionally user friendly. Since all BGAN terminals are "plug and play," the user can be online within minutes. This is a key feature for the Netted Humanitarians of the RTAT since they need to be highly mobile and having the capability for rapid connectivity is absolutely critical. When conducting post disaster assessments in a chaotic environment the last thing a Netted Humanitarian needs to worry about is setting up a complicated piece of equipment. As far as portability, smaller BGAN models such as the Hughes 9202 weigh just over 3 pounds and easily fit inside a backpack (Hughes, 2012). Despite its small size, the Hughes 9202 is capable of broadcasting a Wi-Fi signal within a 100 meter circumference area in addition to having an RJ45 connector for direct connection (Hughes, 2012). Additionally, as seen in Figure 1, the Hughes 9202 is also capable of fitting inside a small protective case (smaller than 2 foot by 2 foot) complete with space for a laptop computer and phone handset.

Figure 1. BGAN in Hardened Case

Despite packing a lot of performance into a small package, the BGAN does have limitations and drawbacks. The primary drawback is that the cost required to use the BGAN is higher than other portable SATCOM devices such as the Very Small Aperture Terminal (VSAT). The approximate cost for a BGAN device ranges from $2500 to $7000, depending on the make, model and features. BGANs have a high cost of service primarily due to the data plans offered, which are based on data usage vice flat monthly fees. The current rates are between $2.50 and $7.50 per megabyte depending on volume purchased (Inmarsat, 2012). Furthermore, BGAN connectivity can become degraded when the number of users is high. This scenario was experienced during the relief efforts for the Haiti earthquake in 2010. Haiti BGAN users experienced significant degradation of service due to the number of units deployed, especially during peak hours of use. In Haiti, this was between 5–7 PM eastern standard time when TV networks broadcasted the nightly news via Skype. Also, the BGAN runs on Subscriber Identity Module (SIM) cards that can only be utilized for a designated amount of download bandwidth. Unfortunately, this bandwidth can be quickly maxed out, which creates the need to carry multiple SIM cards. Additionally, like all SATCOM devices, the BGAN requires Line of Sight (LOS) to the satellite. This can be a challenge when operating in

urban environments with many buildings or in highly forested areas with thick tree cover. Moreover, since BGAN technology operates in the L frequency band (1.5 to 1.6 GHz), it is susceptible to degradation in heavy rain and other types of precipitation. Finally, the BGAN is limited in bandwidth (256~400 kbps) and thus can become overburdened and provide slow connections speeds if more than 2–3 users are connected at once. However, it is quite adequate for a single user or small team looking for an easy to use and reliable gateway that provides reach-back capability.

b. VSAT

Another technology with possible applications for use by members of the RTAT is the Very Small Aperture Terminal (VSAT). Similar in many ways to a BGAN, VSATs also come in a variety of sizes and weights but generally have a higher throughput than BGAN units. The higher throughput provides several advantages. For example, VSATs are capable of supporting much better speed video uplinks and can accommodate more users without increased latency. This is a highly desirable trait for the Netted Humanitarian as it is highly conceivable that they would be recording surveillance video of the on-the-ground situation for transmission back to the C2 center or utilizing COTS technology such as Skype. Furthermore, some VSATs are capable of using multiple radio bands such as X, C, Ka and Ku and can connect to an assortment of satellites. This capability provides the user with added flexibility and gives them access to high speed bands such as the Ka band.

Though not as user friendly or simple to use as a BGAN, they are simple enough to set up that most users will be online in less than 10 minutes. Some models, such as the Viasat SurfBeam 2 Pro Portable, come in a relatively small and ruggedized form factor. When disassembled, the Pro Portable fits inside a modest sized case which can be checked in as baggage on commercial airplane flights (See Figure 2). The Pro Portable also contains a four-port Ethernet router and an optional battery pack, which provides up to four hours of power. Despite its small dimensions it is still capable of impressive performance standards, offering up to 40 Mbps download and 20 Mbps upload speeds (ViaSat, 2012). Just as important, the Pro Portable is designed to be set up

and operated by one individual. VSAT equipment in this man-portable auto-acquire rapid deployment class costs in the vicinity of $20,000 (Honig, 2012). Service for VSAT is normally a flat rate monthly fee based on upload/download speeds.

Figure 2. ViaSat Surfbeam 2 Pro Portable VSAT (From Honig, 2012)

c. RO Tactical Radio–"Netted Iridium"

Two of the most important technology requirements for any gear associated with the Netted Humanitarian are simplicity of use and reliable voice communications. Time is of the essence in disaster relief. This is especially true in the early assessment phase within the 12–24 hour window after a disaster has occurred. While a BGAN or VSAT provides the critical link to the Internet backbone, they require setup and a moderate level of operator proficiency. In contrast, the RO Tactical Radios developed by NexGen Communications operate at the push of a button to provide critical satellite based Push-To-Talk (PTT) voice communications. Obviously, there are times when the higher bandwidth and increased capabilities of a BGAN or VSAT are necessary, but there are other occasions when quick and secure satellite communications

at the push of a button are more desirable. The RO Tactical Radio is simple for the operator to use, operating in a fashion similar to a secure “walkie-talkie” (Figure 3). By utilizing the Iridium satellite constellation the radio requires no ground infrastructure. With the PTT feature, the operator has the ability to communicate with thousands of other RO Tactical Radios within a 100–250 mile radius (Exelis, 2012). The radios are also equipped with an embedded GPS receiver, which utilizes the same antenna used for voice communications. Another useful function provided by the radio is its ability to transmit encrypted Position Location Information (PLI) in either Global or Regional mode. Global mode transmits PLI data securely from anywhere in the world to the DoD Gateway. Regional mode transmits data to multiple RO Tactical Radios configured to operate in Data Collector mode. This feature provides local personnel awareness of friendly forces.

Figure 3. NexGen RO Tactical Radio (From Exelis, 2012)

The RO Tactical Radio is part of the Distributed Tactical Communications System (DTCS) which is managed by the Defense Information Systems Agency (DISA). The DTCS is a satellite communications system that incorporates Iridium satellite technology, software and commercial GPS (Exelis, 2012). Additionally, DTCS provides Beyond-Line-of-Sight (BLOS), Over-the-Horizon (OTH), and On-the-Move, one-to-many tactical voice and data communications. The RO Tactical Radio, or “Netted Iridium” as it is also known, is currently in use by U.S. military forces in Afghanistan as a secure voice communications and Command and Control (C2) tool. While designed for military use, the Netted Iridium system could easily be applied for humanitarian use by an RTAT. The RTAT Team Leader would have a powerful PTT voice communication tool that allows them to seamlessly and quickly communicate with individual Netted Humanitarians deployed throughout the disaster zone. Furthermore, using the PLI capability, the RTAT Team Leader would possess a powerful C2 tool that would provide visibility over the status and location of the individual Netted Humanitarians. This would allow the Team Leader to redistribute and reallocate his resources as the situation changes. For the Netted Humanitarians, the PTT feature affords the ability to communicate with each other simultaneously as long as they are in the same talk group, as well as with the C2 cell with ease and simplicity and in a small form factor. Furthermore, as shown in Figure 4, there are large number of peripherals that would allow the operator to tailor the radio kit for maximum efficiency depending on specific needs and mission requirements. The only significant training that would be required by RTAT personnel would be learning to configure the radios to proper voice nets, encryption keys and PLI settings. The primary drawback to utilizing the system in HA/DR missions is the cost of the radios themselves, which are priced at approximately $4500 plus the costs of any ancillary equipment purchased, such as car mounts, headphones and handsets (Exelis, 2012). Service costs currently run at a flat monthly rate of $90 per radio (Exelis, 2012). However, despite the cost, the system provides a significant amount of capability that could greatly aid initial assessment efforts of a RTAT.

Figure 4. NexGen RO Tactical Radio Peripherals (From Exelis, 2012)

d. DeLorme inReach Two Way Satellite Communicator

Considering the chaotic nature of the disaster zone in the immediate aftermath of a natural disaster, the safety of first responders always needs to be a concern. Conducting an initial assessment often requires first responders to enter destroyed buildings and other infrastructure and to be deployed to dangerous and/or lawless regions within the disaster area. In situations such as these, a portable communication tool that can quickly and easily be used by a first responder to send an SOS emergency message or to forward critical status updates could prove beneficial in conducting early assessments. The DeLorme inReach is a two-way satellite communicator that is roughly the same size and weight as a smartphone. It utilizes the Iridium satellite constellation, which provides worldwide coverage. In addition to having a small form factor (Figure 5), the inReach communicator is waterproof, buoyant and impact resistant. All are highly desirable traits to have in a disaster zone. It is powered by 2 AA batteries, with a tested battery life of 125 hours with remote tracking set to one tracking point every 10 minutes (Delorme, 2011).

Figure 5. DeLorme inReach Two-Way Satellite Communicator (From DeLorme, 2011)

The inReach communicator can be operated in stand-alone mode, or it can be paired via Bluetooth technology with an Android or IPhone smartphone, or with the DeLorme PN-60w handheld GPS. In stand-alone mode it is capable of sending up to three preloaded messages and has an SOS button for emergency assistance with a delivery confirmation feature for all sent messages. The user also has the ability to enable or disable remote tracking. The remote tracking feature can be set to update the user's position at a variety of time intervals, or can be disabled in order to save battery life. Utilizing remote tracking allows colleagues and early responders to have access to the route taken by the user for informational or emergency purposes. When paired with the DeLorme PN-60w handheld GPS device the device is capable of text messaging to email addresses or cell phones up to a maximum of 160 characters per message (DeLorme, 2011). Furthermore, this mode provides Interactive SOS capability, which allows the user to describe the situation in detail in order to improve emergency response and to stay in touch with the GEOS International Emergency Response Coordination Center (IERCC). Though obviously not as robust as the RO Tactical Radio, the inReach still provides a useful capability that could be utilized by Netted Humanitarians in their mission. Additionally, the cost for the units is a fraction of the cost of the RO Tactical Radio. If money is an area of concern when outfitting the RTAT Netted Humanitarians, than

inReach is a much more palatable option. The units cost approximately $250 each, plus another $275 for the handheld GPS when utilized in that mode (DeLorme, 2011). On the down side, the company does not currently offer any pay as you go plans. Instead, DeLorme offers seasonal or annual plans that begin at $9.99 a month (DeLorme, 2011).

e. Satellite Phones

One of the most commonly used and trusted tools for those who need to communicate from remote locations is the satellite phone. Consequently, the satellite phone is very applicable to the mission of first responders. With terrestrial cell antenna tower and networks normally heavily damaged or destroyed by a natural disaster, satellite phones are often an indispensable and proven communications tool during disaster relief. The Netted Humanitarians of RTAT are likely to appreciate the small size and portability of the satellite phone, in addition the ruggedized and small form factor of the devices. Satellite phones come in a variety of shapes and sizes and manufacturers offer a variety of models in order to meet the varying needs of customers. Two of the largest providers of satellite phones are Inmarsat and Iridium.

Inmarsat is the oldest satellite phone service operator and provides coverage via 3 geostationary satellites. Like all geostationary satellites, they suffer from a lack of coverage in the Polar Regions (above 70 degrees north and below 70 degrees south latitude) due to the extreme look angles and higher probability of interference. This is offset by the higher bandwidth available from geostationary satellites with connection speeds of 60–512 kbps. Models such as the Inmarsat IsatPhone Pro (Figure 6) offer a robust handset that can be operated in a multitude of weather conditions, is GPS enabled, voice and messaging capable, and has a battery life of up to 8 hours of talk time and 100 hours on standby (Inmarsat, 2012). Unit cost for this model is approximately $555 with a choice of either monthly or pay-as-you-go service plans (Inmarsat, 2012). Monthly service plans run between $30 and $60 depending on the number of minutes purchased (Inmarsat, 2012). Pay-as-you-go plan costs depend on the number of pre-paid units purchased and validity period of the units, current rates range from approximately $1–$1.75 per unit (Inmarsat, 2012).

Figure 6. Inmarsat IsatPhone Pro Handset

Iridium, on the other hand, operates a constellation of 66 Low Earth Orbit (LEO) satellites (Iridium, 2012). LEO satellites offer several advantages over geostationary satellite systems; most noticeable is that they can provide true worldwide coverage including the Polar Regions. Additionally, LEO systems are able to track a mobile unit's location by using Doppler shifts between the satellite and the mobile unit. Iridium's Extreme Satellite Phone (Figure 7) is comparable to other higher end satellite phone models. A convenient feature offered by this model is the addition of an SOS button that transmits directly to the GEOS IERCC. Unit cost for this model is approximately $1375 with a choice of monthly and pay-as-you-go plans (Iridium, 2012). Monthly service plans cost approximately $40 which average out to airtime charges of $1.08 per minute (Iridium, 2012. Pay as you go airtime charges on the other hand average $2.00 per minute (Iridium, 2012).

Figure 7. Iridium Extreme Satellite Phone

Despite the advantages offered by satellite phones with regard to portability, ease of use and worldwide coverage, they do suffer from certain limitations. Satellite phone networks are often prone to congestion as satellites and spot beams have a tendency to cover a large geographic area and offer relatively few voice channels. This reality is magnified post-disaster when the number of satellite phone users increases exponentially. Additionally, airtime charges, especially for data transmission are very expensive unless the user has signed up for a pre-paid plan. Finally, satellite phones are notorious for having short battery lives, which can quickly become a problem to a Netted Humanitarian trying to remain lightweight while conducting assessments on foot.

2. Data Fusion Software

The difficulties encountered by the IHC in attempting to share and integrate information that originates from numerous data sources are well documented. Identifying software solutions that are capable of finding useful connections in disparate data sources needs to be a priority for the IHC and the USG. Neither entity can afford to continue

down the current path of wasteful and inefficient allocation of resources and continued lack of interoperability that is rampant in the current disaster response process. A firm that has made significant progress in developing data fusion software is Palantir Technologies. Taking its name from the magical all-seeing crystal balls of J.R.R. Tolkien's mythology, Palantir was founded by a group of PayPal alumni and backed by Peter Thiel, one of PayPal's co-founders ("Big data: Crunching the numbers," n.d.). Data fusion is a multilevel, multifaceted process dealing with the automatic detection, association, correlation, estimation, and combination of data and information from single and multiple sources (Koks & Challa, 1994). Palantir specializes in building data fusion systems that gather information from different sources and then attempts to find connections that can be utilized by the user to answer questions. Among the first customers to utilize the software were the Central Intelligence Agency (CIA) and the Federal Bureau of Investigation (FBI), who utilize it to connect individually innocuous activities such as taking flying lessons and receiving money from abroad to spot potential terrorists ("Big data: Crunching the numbers," n.d.).

Having an open Application Programming Interface (API) is one of the most attractive attributes of the Palantir software. An API is a language and message format used by an application program to communicate with the operating system or some other control program such as a database management system (DBMS) or communications protocol. By containing an open API, Palantir has allowed its data fusion software platforms to serve as the foundation for developing whole new applications. The importance of this in the context of HA/DR cannot be understated. The issues faced in sharing information and achieving data fusion between responding organizations is well known. Even if the responding agencies are able to break through organizational barriers and are willing to share information, there is often incredible difficulty encountered in fusing data from various sources into a comprehensible and accurate Common Operating Picture (COP). Each relief agency maintains its own databases and utilizes a unique IT architecture that does not allow for ease in information sharing. Middleware like Palantir is capable of circumventing this issue by becoming the data integration layer for the

HFN. This capability allows the HFN to make sense of the massive amounts of disparate data available from multiple information sources.

It is very important for application developers to include an API which provides a means for requesting program services. Building an application with no API is akin to building a house with no doors. The API for computing purposes is how you open the blinds and the doors and exchange information. As time goes by, the likelihood that another developer will need to tap an application's services increases. Data fusion software like that developed by Palantir must have an open API in order for future applications to be able to interface with it. With the rapid pace at which technology is improving, this design feature is imperative. As new applications continue to be developed, being able to integrate in a "plug and play" manner with existing IT infrastructure is crucial. This is even more important in an HFN environment that finds it nearly impossible to agree on standardization of processes, software protocols, semantics, data structures, and data warehousing.

Utilizing data fusion software allows for HFN users to ask the questions that deal with the status, requirements and available resources for responding to the disaster, without having to go through the slow and tedious process of data mining through mountains of information from disparate sources. Using this type of software utilizes the processing power of computers to figure out how to query numerous databases and bring back valuable data in a coherent form to the responders. Having an open API allows for applications developed in the future to more easily integrate with the software. As HA/DR organizations focus on developing application tools to make their relief efforts easier, they can rest assured that the data fusion software they want to operate with will allow them easy access.

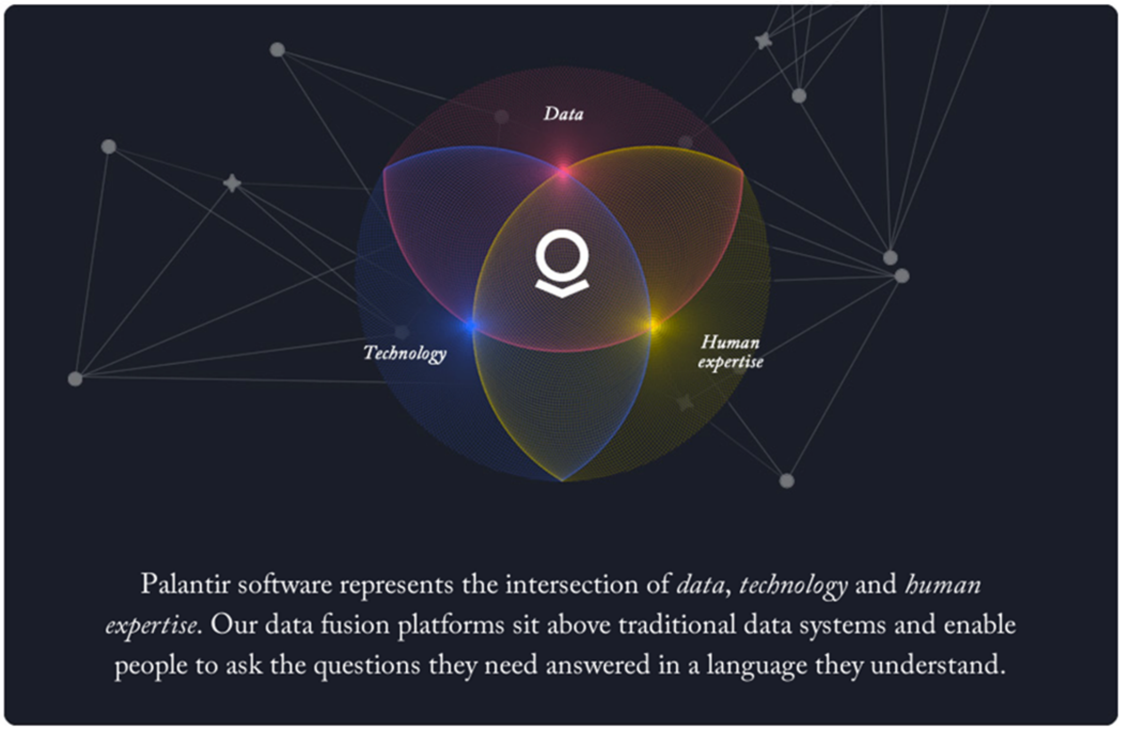

Figure 8. Representation of Palantir Data Fusion Software (From Palantir, 2012)

3. Additional FLAK Equipment

In addition to the variety of primary communications equipment available for use by the Netted Humanitarian, other important items are required to round out the FLAK. While this additional equipment could be considered secondary in nature, its importance to the mission of the RTAT Netted Humanitarians cannot be understated.

One of the largest areas of concerns for first responders when deployed to the disaster zone is the availability of power sources. There is a very high likelihood that the power infrastructure of the affected area will be unavailable or severely degraded. For this reason, having portable power sources available to run electrical equipment is of utmost importance to the Netted Humanitarian. The power source must be lightweight and portable in addition to having the ability to power the communications equipment for extended periods of time. First responders require a variety of inputs and outputs to include 12V ports, USB ports, and AC outlets to power their gear. Additionally, rapid charging solar power panels and power inverters are crucial. These requirements make

portable solar charger kits that combine these capabilities, such as the Goal Zero Extreme Explorer Kit (Figure 9), an indispensable tool for first responders.

Figure 9. Goal Zero Extreme Explorer Kit

Other gear that should be included in the Netted Humanitarian FLAK includes:

- Hands free recordable camera with live-streaming capability
- Tactical Communications Vest
- Gear Bag Expedition-type
- Ruggedized laptop
- Ancillary support equipment (Cat-5 cable, batteries, flashlight, headlamps, etc.).

H. MOVING TOWARD IMPLEMENTATION

The technology and equipment described in this chapter provides a great amount of flexibility in the FLAK options available to the Netted Humanitarian. Furthermore, the rapid pace of technological development ensures that newer technology will continue to redefine the capabilities of the Netted Humanitarian. In addition, this chapter clearly established the urgent requirement for a rapidly deployable and self-sufficient ICT assessment team. The next chapter will focus on taking the vision of the Netted

Humanitarian from the conceptual stage to actual implementation. Finally, the following chapter will describe three concrete examples that outline the resulting improvement in the ICT assessment process that can be expected from RTAT and the Netted Humanitarian.

THIS PAGE INTENTIONALLY LEFT BLANK

IV. IMPLEMENTATION AND RESULTING PROCESS IMPROVEMENT

One of the roadblocks to making RTAT a reality is that the idea will not transcend from a theoretical idea to actual implementation. This would be an unfortunate turn of events and would miss out on the opportunity to more effectively integrate and capitalize on the combined talent and experience of the first responder community. After action report reviews that are held to assess the performance following devastating events repeatedly call for a stronger coordination among agencies engaged in disaster operations. Such coordination cannot occur without an effective process of communication. Communication has both technical and social components, each affecting the other and producing potential failure as well as probable strength. Failure in technical systems of communication almost certainly triggers failure in organizational performance under the rapidly changing condition of disaster (Gibbons, 2007).

This section describes a possible manner in which the vision of RTAT and Netted Humanitarians can become a reality in the future. What is described in this section is merely a possible roadmap that stakeholders can utilize to implement RTAT with the goal of improving the current disaster assessment process. The proposed implementation solution is focused on improving current shortfalls in the disaster response arena and is based on case studies and lessons learned from recent disasters. The aforementioned case studies and lessons learned have repeatedly enumerated and described in detail shortcomings of the current assessment process as well as the difficulties faced by first responders from across the IHC. Examples of these shortcomings, and how RTAT and the Netted Humanitarian concepts can help overcome them, are detailed in this section.

A. IMPLEMENTATION PROPOSAL

1. Stakeholder Involvement

Disaster response organizations agree almost unanimously that a better early disaster assessment process is needed in order to provide relief to those in need in a quicker and more effective manner. However, despite the numerous benefits to disaster

response offered by better collaboration, cooperation and sharing of information, convincing multiple organizations to follow through with wholesale organizational change is indeed a difficult and daunting task. No one wants to change their internal processes, organizational culture and identity in the hopes that this might lead to a better disaster response process. A more palatable and realistic goal is to engage and convince organizations of the value added by simply providing a small number of SME personnel, perhaps some funding, and most importantly, organizational support for multi-organizational early ICT assessment teams, e.g., RTAT.

A critical component to garnering organizational support from stakeholders is to clearly illustrate the importance the RTAT ICT assessment report will play in facilitating the relief efforts of their organization and the IHC as a whole. The list of possible stakeholders that should be included in the development and implementation of RTAT includes a number of USG agencies, NGOs, United Nations-Office for the Coordination of Humanitarian Affairs (UN-OCHA), United Nations-World Food Program (UN-WFP), philanthropic organizations, academia, and communications industry representatives. Input could also be solicited from nations that have a higher propensity for dealing with natural disasters, and whose military and government disaster relief agency has experience in dealing with the relief process from the perspective of the affected nation. This stakeholder input will also provide a forum to discuss individual concerns and more clearly delineate the manner in which the RTAT will operate prior to deploying to the disaster zone. Usually this type of planning is done during relief efforts when the situation is chaotic and organizations are scrambling to create ad-hoc networks and are attempting to cooperate concurrently while assessing the ICT needs of the affected area. That is not the ideal situation.

2. Proposed Working Groups

Once stakeholders recognize the value added by RTAT and are invested in the development process they can progress to the creation of working groups for specific topics related to implementation. While the vision for RTAT is a new concept, there is a plethora of reference material and similar functional groups or operations that can help

guide the individual working groups through the development process. These include the Disaster Assistance Response Team (DART) Field Operations Guide (FOG) and the United Nations Disaster Assessment and Coordination (UNDAC) handbook. Falling under the purview of the Office of Foreign U.S. Disaster Assistance (OFDA), the primary purpose of a DART is to conduct an initial assessment in order to provide OFDA with information and recommendations to make timely decisions on the USG disaster response. These references have been developed as tools for individuals to utilize if they are sent to disaster sites to undertake initial assessments. Furthermore, the information presented in them is drawn from first-hand experience gained by responders in real-world disaster relief missions. Proposed working groups for RTAT development will now be described in greater detail.

a. Qualifications

This working group would be concerned with outlining the desired qualifications for the Netted Humanitarians that would compose the RTAT. All candidates need to be experts in the operation and maintenance of portable communications equipment. Furthermore, extensive real-world experience in responding to a natural disaster is a highly desirable trait. This working group would also be responsible for delineating the manner in which possible team members are chosen, either through an active recruitment and application process or via nomination to the team by the parent organization. Desirable qualification for prospective Netted Humanitarians includes the operation of satellite communications equipment, portable cellular networks, PTT radios and portable power generation equipment.

b. Training

The training working group would be responsible for designing the training curriculum for team members. This would include outlining the pre-requisite skill sets, training objectives and the learning times that would be devoted to each objective. A key area of responsibility for this working group would be designing coordinated training scenarios or exercises to test the knowledge and actions of the team in a field environment. A possible option to meet this requirement is the identification of

existing HA/DR exercises, or other large exercises with an HA/DR component to the scenario, during which the team could deploy and learn to collaborate in a more realistic environment. Coordinating with USG and/or international organizations to identify and participate in these types of exercises would be a key area of responsibility for the working group. The training working group would also have to stipulate standards for training, technology and equipment standards as well as prerequisites for not IT-field related training and certification requirements such as First-Aid and National Incident Management System (NIMS) and Incident Command System (ICS).

c. Team Structure

Identifying the optimal team structure is dependent on the size, complexity, type, and location of the disaster and the needs of the affected country. The number of individuals assigned to a RTAT is determined by how many people are required to perform the necessary activities to meet the goals and objectives. Maintaining flexibility in team structure and identifying metrics to better match team strength to scenario type will be a key area of focus for this working group. Moreover, developing multiple team structures that correctly match individual SME skills with the magnitude and type of disaster faced by responders is crucial to the success of RTAT. Additionally, support personnel situated away from the disaster zone would be critical in order to more easily manage requests, resourcing and logistics as required.

d. Terms of Reference

Organizational and individual member terms of reference are a major requirement in order to make the vision of RTAT a reality. The organizational terms of reference should be very specific and describe in detail the mission and purpose of RTAT. This working group would be responsible for crafting a road map for what will be accomplished, by whom, how and when. Furthermore, the terms of reference should define the vision and mission, goals, structure, available resources, standards, and timelines. The value in developing terms of reference for the RTAT lies primarily in developing a shared understanding of what it hopes to accomplish in order to develop workable structures and clearly defined action plans. With regard to individual terms of

reference it is important that the roles and responsibilities of each of the RTAT members are clearly delineated and well defined in order to provide clarity to the team members. The final product of this working group will be the RTAT Project Charter, which will become a living document for future iterations of RTAT.

e. Funding

Probably the most critical subject matter for stakeholders to deliberate and achieve some level of consensus on is the mechanism for funding RTAT. Without an agreed upon method for funding RTAT deployment, there is little likelihood that RTAT will ever progress past the conceptual stage. There are numerous existing funding structures for this working group to draw from when formulating a funding plan. One that could definitely apply and holds promise is the UNDAC Model. Under this model, countries are separated into members and participating nations. UNDAC member countries are those countries that provide financial assets in support of their participation in the program. They do this by depositing funds in UN-OCHA “mission accounts” to cover the deployment costs of their national UNDAC members while on a UNDAC deployment (UN-OCHA, 2013). Meanwhile, participating nations provide experts to deploy with the UNDAC team but do not cover the costs of their deployment, which is covered by voluntary contributions of donor countries (UN-OCHA, 2013). Standard deposits into mission accounts are $50K and cover the cost of travel and daily allowances for hotel, food and incidentals (UN-OCHA, 2013).

Attaining support and cooperation from UN-OCHA with regard to funding could be critical for the members of the funding working group. This support would be a significant milestone and would allow for a trusted and respected player in the IHC to provide a sense of legitimacy for RTAT and its stakeholders. With significant experience in managing travel arrangements and accommodations on the ground in disaster zones, UN-OCHA already has an existing infrastructure for funding deployments. This includes a mechanism where notifications are sent to the respective country or NGO when funding reaches a certain level, informing them that their mission account is low on funds (UN-OCHA, 2013). Of particular concern for RTAT is ensuring that funding is sufficient to

cover the high cost of communications equipment and utilization rates for BGAN and VSAT. Finally, training costs are critical to fund, for both the initial and refresher training the team members would require.

f. Assessment Forms

Since RTAT personnel are likely to be among the first responders on the ground in the disaster zone, the results of their ICT assessment will provide crucial information to the IHC in the ensuing days following the disaster. Therefore, their assessment forms need to be designed in such a manner that they can convey important information that is easily understood by first responders from an assortment of responding organizations. This working group would be responsible for standardizing the assessment forms the team would utilize in the field. They should also ensure they coordinate with the training working group in order to ensure that use of the assessment forms is part of the training curriculum and is also utilized during training exercises. Since the forms are concerned with annotating the status of the ICT infrastructure, there should be multiple forms designed for different types of communications systems that need to be assessed for capability. These include the post-disaster status of satellite communications (VSAT, BGAN, Satellite Phone), terrestrial communications (copper, fiber optic, DSL, Cable, T-1, ISDN), cellular and wireless communications and conventional radio communications (HF, VHF, UHF, AM/FM broadcast).

In an effort to easily compile and maintain the information gathered using these forms, members of this working group should ensure that electronic versions are available for use by Netted Humanitarians. The gathered information would then need to be stored and organized in a manner that allows for the maximum level of information sharing between responding organizations. The goal would be to have the RTAT C2 site become a central coordination center for follow-on humanitarian responders to utilize in order to collaborate on restoring the ICT infrastructure to assist overall recovery efforts. Figures 10 to 14 are an example of an RTAT assessment form for cellular and wireless infrastructure status.

	Baseline Assessment - Mobile & Communications Operator			
	General Info - For Baseline Assessment			
1	Name:			
2	Notes:			
3	Network/Holding/Parent Group:			
4	Government legislative body			
	Market Information			
5	% of Mobile Phones in country:			
6	Approximate number of towers:			
	Services Y/N			
7	SMS			
8	Cell Broadcast			
9	EDGE			
10	3G			
11	4G			
12	VoIP			
13	Reverse Billing			
14	USSD			
15	Mobile Banking		If Y What Partner	
16	Mobile fundraising Experience		if Y which campaigns/ with whom	
	Contacts & Locations			
17	Executive/Administrative/CSR Contact			
18	Technical Contact			
19	NOC Location & Notes			
20	Note structural/building characteristics that may be relevant, power, redundant comms			
21	HQ Location & Notes			
	Emergency Procedures			
22	Additional Contacts			
	(include one off-country if possible)			
23	Emergency Partners			
24	Emergency TOR or LOI established with other parties?			
25	SMS Gateways			
26	SMPP, HTTP, Other (describe)			
27	Voice			
28	VoIP, Other			
29	USSD			
30	Would be willing to collaborate on deploying emergency-related VASs?			
31	Possibility to obtain real time coverage maps during Disasters			
32	Would be willing to share Geo-referencing information about subscribers in limited cases?			

Figure 10. Cellular/Wireless Assessment Form (1 of 4)

	Post Disaster Assessment - Mobile & Communications Operator									
			Operator 1		Operator 2		Operator 2		Operator 4	
1	Time of assessment post disaster									
2	Region									
3	Regional Contact									
4	Regional up to date coverage maps available									
	Network Status									
5	%age Sites out of action									
6	%age coverage in Region pre disaster	2G								
7	%age coverage in Region post disaster - Minimum	2G								
8	%age coverage in Region post disaster - Current	2G								
9	%age coverage in Region pre disaster	3G								
10	%age coverage in Region post disaster - Minimum	3G								
11	%age coverage in Region post disaster - Current	3G								
12	%age coverage in Region pre disaster	4G								
13	%age coverage in Region post disaster - Minimum	4G								
14	%age coverage in Region post disaster - Current	4G								
	Network Restrictions/Congestion									
15	Voice									
16	SMS									
17	Data									
	Power									
18	%age sites still under mains power									
19	% defecit of emergency power (sites without emergency power - Gap)									
20	Fuel Supply - OK									
21	Fuel Logistics issues									
22	Power - Notes									
	Public Services - offerred									
23	Emergency Charging Points									
24	Credit Recharge Services									
25	Additional RQD -Emergency Charging Points									
26	Additional RQD Credit Recharge Services									
27	**Known Gaps in service**									
	Geographical areas without comms		Area 1	Gap	Area 1	Gap	Area 1	Gap	Area 1	Gap
			Area 2	Gap	Area 2	Gap	Area 2	Gap	Area 2	Gap
			Area 3	Gap	Area 3	Gap	Area 3	Gap	Area 3	Gap
			Area 4	Gap	Area 4	Gap	Area 4	Gap	Area 4	Gap
28	**Urgent Points of Interest - without Comms**									
	Hospitals	Name	Location	Requirement	Name	Location	Requirement	Name	Location	Requirement
	Schools	Name	Location	Requirement	Name	Location	Requirement	Name	Location	Requirement
	Evacuation centres	Name	Location	Requirement	Name	Location	Requirement	Name	Location	Requirement
	Government distribution Point	Name	Location	Requirement	Name	Location	Requirement	Name	Location	Requirement
	NGO/ 1st Responder locations	Name	Location	Requirement	Name	Location	Requirement	Name	Location	Requirement

Figure 11. Cellular/Wireless Assessment Form (2 of 4)

Ministry of "Communications" or equivalent			
General Info			
Name of ministry			
Areas of responsibilities			expected: licensing governance over airwaves (GSM, HAM, Sat)
Emergency contact:			
Ministry of "Interior"/"Planning" or equivalent			
General Info			
Name of ministry			
Areas of responsibilities			expected: updated geographic, demographic information
Emergency contact:			

Figure 12. Cellular/Wireless Assessment Form (3 of 4)

Local Organizations			
General Info			
Organization Name			
Emergency Contacts (mobile phone, email, Skype)			
Capabilities		Localization / Translation / Local tech support / Local tech development / Mobile data collection / GIS expertise	
Existing international customers			
Tech Community			
Have there been local bar camps, criss hackathons, or similar informal events?			
Is there a GIS community, OSM group, or other local mapping-related organizations?			
Are there prominent bloggers/social media participants that may becomes a good voice to collect tech-savvy volunteers, in-country or abroad?			
Crisis Mappers?			
Walking Papers?			

Figure 13. Cellular/Wireless Assessment Form (4 of 4)

g. Equipment

The previous chapter described a variety of available equipment that the Netted Humanitarians of RTAT could utilize in order to accomplish their mission. This working group would be responsible for making final decisions on the specific equipment and technology that would compose the Netted Humanitarian FLAK. Since there is an obvious cost associated with purchasing and usage costs of the equipment in the FLAK, close coordination with the funding working group is of utmost importance. Furthermore, the equipment working group must coordinate with the training working group in order to ensure the team members are training on the technology and equipment the working group decides upon. Special consideration needs to be taken into account to allow for ease of interoperability with the technology and equipment commonly used by other member of the IHC.

h. Operations

Aside from having a Team Leader who will act as primarily a coordinator and the Lead SME, the operations of the RTAT will be much more decentralized rather than hierarchical in nature. This structure will align much more closely with the way NGOs and the majority of the IHC organizations are structured when responding to a disaster. Despite this fact, there has to be some standards and logic for the manner in which the team will operate once on the ground. In order to ensure the team is fully prepared to conduct ICT assessment operations, this working group will have to coordinate with each of the other working groups to strive for effective operations. The end result of the efforts of this working group will be documents that outline the Concept of Operations (CONOPS), Standard Operating Procedure (SOP) and Tactics, Training, and Procedures (TTP) for the RTAT.

i. Logistics

Although the Netted Humanitarians of RTAT are expected to be self-sufficient to the maximum extent possible, the team supplies are likely to be exhausted within 7–10 days. Having a logistics system in place to resupply the team depending on the length of the deployment is crucial. Depending on the scope of the disaster and the

impact on the local area, these supplies may have to travel long distances to get to the team. This working group would be dedicated to building a supply chain infrastructure and developing working solutions to ensure that the team arrives on scene prepared to conduct its mission, and that it will remain resupplied for the entire length of the deployment. The U.S. military members of RTAT will likely play a critical role in this working group, due to the enormous heavy lift and resupply capabilities of the U.S. military.

B. PROCESS IMPROVEMENT AREAS

1. Standardized Training Improves Effectiveness and Efficiency

One way to strengthen relationships and pass on organizational memory is disaster management training. Training plays a vital role in disaster preparedness. Often the training sessions, whether they are disaster simulations, seminars, or informal meetings, not only provide knowledge and skills, but also facilitate and strengthen relationships among responders (Gibbons, 2007). For these reasons, it is imperative that the Netted Humanitarians of RTAT are trained to the same standards. By training and conducting exercises together the team will build familiarity and trust that are crucial to success during real-world disasters.

The current processes for training first responders are disjointed and do not prepare them for the realities they will encounter during a disaster relief mission. Once the first responders arrive in the disaster area and are exposed to the chaos and confusion of relief efforts, they often are overwhelmed and fall into defensive positions and do not coordinate well (Denning, 2006). The presence of multiple agencies with multiple jurisdictions is daunting and is exacerbated by incompatible communications equipment and differing incident management processes. Moreover, the training is fragmented because it is normally conducted internally by individual organizations. Each organization has its own training requirements and standards for their first responders and volunteers, which usually are not focused on preparing its members to effectively and efficiently collaborate and coordinate with responders from other responding organizations. Furthermore, programs like NIMS and ICS that were created to train

personnel who are directly involved in emergency management and response are focused on federal, state, and local government responders, not on NGOs and international aid organizations. The reasoning for NIMS training, which was intended to aid people who do not usually work together or even know how each other operates to seamlessly respond to and recover from a disaster, is sound in principle and could be used as a model for creating the training curriculum for RTAT members. However, there needs to be a strong focus within the RTAT community on putting some weight behind NIMS-like training. It needs to be more than just lip service.

One of the most commonly identified areas for improvement in disaster relief missions is improving the way the IHC trains and exercises. Perhaps the key mechanism for testing, practicing, refining, and inculcating new lessons-derived behaviors is exercising (Donahue & Tuohey, 2006). RTAT exercises need to find a balance between being challenging, while at the same time realistic. It is far easier to train and design exercises for known emergencies than it is to create, refine and implement unknown emergency scenarios. Either way, the exercises must cement the concepts taught in training classes and seminars while at the same time pushing the boundaries of what the trainees are capable of handling. In order to prepare them for the how events will unfold in a real disaster, responders must feel what it is like to be overwhelmed and learn to adapt and overcome the difficulties they are sure to encounter.

Those responsible for designing and evaluating RTAT training scenarios must also change some of the ways in which they conduct and evaluate scenarios. Exercises should be recast as learning activities targeted at improving performance, not punitive tests where failure is treated with disdain (Donahue & Tuohey, 2006). Mistakes are bound to happen; the focus should be on learning from them. Finally, training exercises need to be more narrowly focused on accomplishing a limited set of training objectives, rather than attempting to accomplish a wide-ranging set of objectives. This stipulation will serve to ensure that the goals of the exercise are explicit and cut down on confusion both on the part of the participants and planners. Maintaining exercises of a smaller scale,

with more specific goals, will also help ensure that the trainees are gaining more value from the objectives of the exercise, rather than receiving superficial exposure to training regarding a large number of objectives.

Receiving classroom training that will be reinforced through training exercises and scenarios will serve to ensure that the Netted Humanitarians of RTAT learn to operate together as a tight knit unit. They must be trained to operate their gear when time is of the essence. They must be skilled at deploying quickly to a disaster zone and beginning the ICT assessment in an expeditious manner. Therefore, the training needs to be focused on instilling these skills in the team members until it is second nature and they operate like a finely tuned machine. Since the Netted Humanitarians are already SMEs in their areas of expertise, much of the focus will be on teaching tactics, concept of operations and working together as a team. Receiving this type of training will create a camaraderie and esprit de corps that will greatly benefit the team when it is deployed to disaster zone where confusion reigns. Moreover, the team will learn to be not only effective in accomplishing their mission, but to be efficient in conducting the ICT assessment as well. The grave nature of disasters and the limited time and personnel resources that are likely to be available make efficiency of operations a critical skill set to possesses and maintain.

2. Data Fusion Improves Collaboration and Coordination

As discussed in Chapter III, it is nearly impossible for multiple responding organizations to effectively and efficiently collaborate in assessing the various needs of the affected area without sharing information with one another. Data fusion software that is capable of combining disparate sources of information into one situational awareness tool that is accessible by all stakeholders is a crucial asset. The current process for fusing data is disjointed, thus collaboration and coordination between responding organizations is painful and inefficient. Despite sharing the common goal of assisting the affected population, and even if responding organizations have developed the trust required to share information, creating an all-inclusive COP is very difficult. Each organization will likely have its own pre-existing methods to model and share their situational awareness.

Fusing this information into one COP is affected by everything from differences in human languages, database schema, collection methodology, and problem domain (Palantir, 2012).

In order to achieve the important tasks of HA/DR, such as ICT assessment, coordination of effort, triage, and getting good data into the hands of decision makers and aid workers, responders need to integrate that knowledge into a common operating picture that accurately models the evolving situation on the ground. This is especially true in the collection of ICT assessment data. Not having the tools to communicate, or not having a knowledge of what parts of the ICT infrastructure were affected by the disaster, directly impacts all facets of relief efforts. Therefore, data fusion software is important to RTAT's mission of gathering and collecting the results of their ICT assessment.

Palantir has already utilized its data fusion software product in two highly visible disaster relief missions. The first of these was in response to the Haiti earthquake of 2010. The ad-hoc collection of military and civilian organizations that came together to provide relief resulted in the usual difficulties in collaborating and sharing information. Each organization maintained a detailed picture of their area of responsibility, but a shared COP did not exist. To address this problem Palantir Philanthropy Engineers set up a publicly available instance of their Palantir government data fusion software. This allowed for the creation of a COP that compiled relevant open-source data of the situation on the ground in Haiti to assist relief workers in their mission.

The instance of the COP created by Palantir included the locations and names of collapsed buildings, Internally Displaced People (IDP) camps, and SMS message hotspots (See Figure 14). Adding in map layers allowed decision makers to be able to find out what administrative zones any point on the map were located in. Additionally, the mapped data allowed user to access the information via a suite of visualization, analysis, querying and collaboration tools that gave them the ability to receive useful information to practical questions. For example:

- Which administrative sectors have had the most SMS requests for food in the past 24 hours?

- What collapsed buildings are there that may contained hazardous materials that will require special cleanup?
- Are any IDP camps near enough to these hazmat sites to warrant special precautions or moving the residents?
- What is the status of wireless/cellular communications in a particular sector?
- What is the status of restoring ground based copper wire communications in a particular sector?

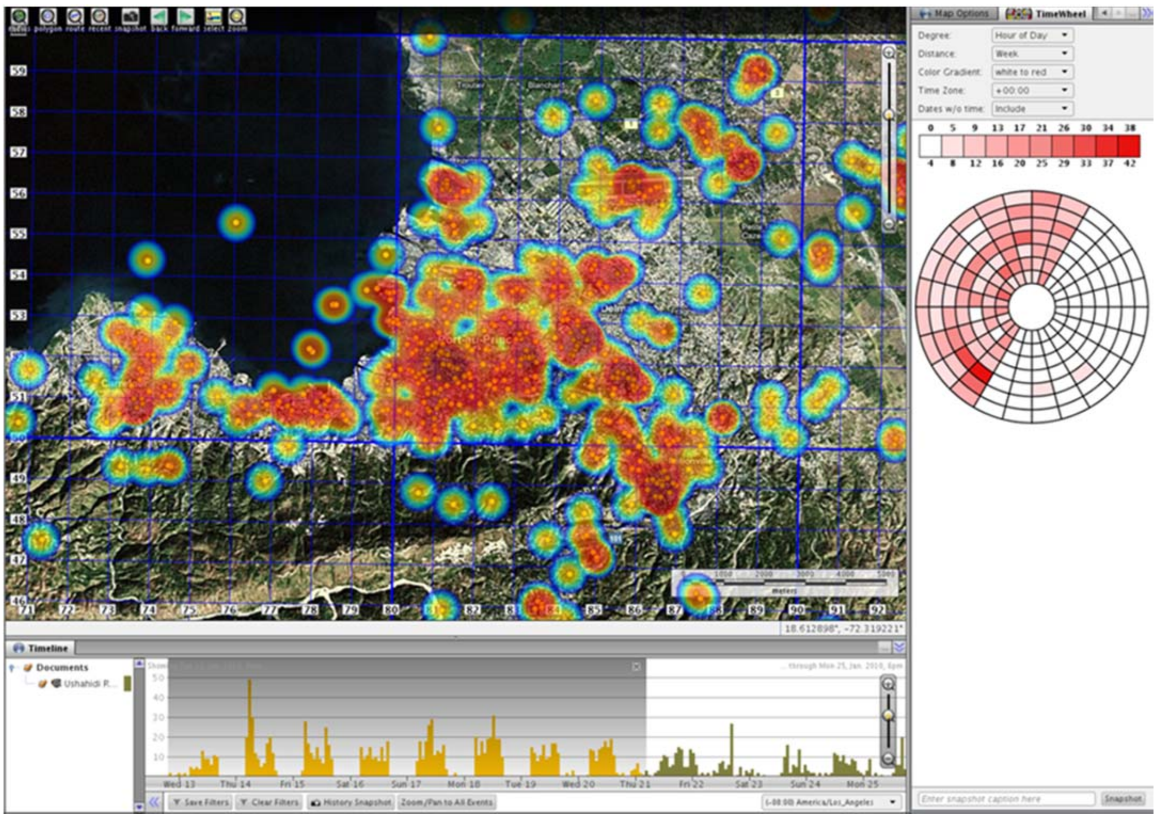

Figure 14. Visualizing SMS hotspots following the Haiti earthquake in Palantir (From Palantir, 2012)

A more recent example that depicts how powerful data fusion software can be during an HA/DR mission took place during relief efforts in New York City after Hurricane Sandy struck the region in late October 2012. This time around, Palantir's Philanthropy Engineering team deployed to the Rockaway neighborhood of Queens to assist a non-profit relief organization composed of military veterans, known as Team

Rubicon. Operating from a parking lot on Rockaway Beach Boulevard, Team Rubicon volunteers utilized Palantir software to create a Hurricane Sandy relief instance.

Palantir's data fusion software allowed relief coordinators from Team Rubicon to utilize the instance to create a COP that gave them the ability to accurately track the position of their volunteers in the field using GPS. Additionally, volunteers had the capability to upload geo-tagged photos from their smartphones and laptops for later reference and to build a complete situational awareness tool. By combining several layers of information, such as demographic and census data, poverty rates, and even the status of neighborhood pharmacies, the relief workers were better able to prioritize the locations in greatest need of aid (Palantir, 2012). Word spread quickly throughout the course of Hurricane Sandy relief efforts about the success Team Rubicon was having in coordinating and collaborating with other relief agencies to provide relief. Soon, both government agencies and NGOs began sending their volunteers to Team Rubicon headquarters for situational awareness and further tasking (Palantir, 2012).

This type of software holds promise when applied to the mission of the Netted Humanitarians of RTAT. Netted Humanitarians can begin the critical process of populating and updating a real-time COP that is easily accessible and simple to update. As they begin the difficult yet critical task of assessing the status of the ICT infrastructure, they can begin to create a situational awareness tool that follow-on first responders can utilize to prioritize needs and streamline relief efforts. Creating a network environment that allows information from disparate sources to be consolidated in a single situational awareness tool is a very powerful asset. This shared environment solves many of the issues faced by first responders in disaster relief missions. Time and again lessons learned have outlined how difficult it is for relief agencies to collaborate and share information when the multiple networks fail to be interoperable. Data fusion software that allows responders to have an accurate picture of the situation is indeed a powerful tool that will allow them to focus on conducting the crucial task of relief and recovery efforts, rather than spending an inordinate amount of time and resources guessing what the priorities might be. Giving decision makers the information they require to make timely and informed decisions would greatly improve the current disaster relief process.

3. RTAT Creates Liaisons for Responding Organizations

When natural disasters strike, a multitude of first responders from the IHC deploy to the disaster zone with the goal of providing relief to the affected population. These relief efforts range from providing medical supplies and services to establishing reliable communications. The varying missions, organizational cultures and operating procedures makes it very difficult to share information, which is the true life blood of relief efforts. The different backgrounds and areas of expertise of the first responder communities is both a source of strength and an obstacle to cooperation and collaboration.

It is a source of strength in the sense that every one of the relief organizations brings personnel with unique skill sets, they provide important services in their area of expertise, they utilize innovative tools to speed recovery and most importantly they bring indispensable knowledge and experience. The relief workers that form the backbone of the IHC are highly motivated and committed people that take their jobs very seriously. They are adept at embracing the chaos that is inherent post-disaster and in utilizing their expertise in the best way they know how in order to bring relief to those in need. Additionally, they accomplish this with very little in the way of a hierarchical chain of command. However, the individual cultures and preferred manner for conducting relief efforts is an impediment to making the relief process more efficient. Attaining trust and achieving true collaboration between agencies is a constant struggle.

The current assessment process is characterized by multiple assessments conducted by multiple organizations, utilizing stove piped systems that do not talk to one another and are not interoperable. However, the biggest obstacle to effectively assessing the magnitude of the disaster is not the failure to integrate technology but rather the failure to integrate the knowledge held by first responders. The reasons for this are many, but generally revolve around the issue of trust and the lack of communication mediums available to make knowledge management and data integration a reality. On the occasions when this sharing of knowledge between organizations actually takes place, the common theme is that firmly established relationships between the organizations were already in place after having worked together in the field on previous disaster missions.

Adding to the collaboration issues, some organizations just prefer to work on their own and are more averse than others to coordinating efforts. This is especially true in the often conflicting cultures and operating norms of military first responders and some NGOs. This is often exacerbated by the requirement some NGOs have to remain neutral in certain countries and during conflicts. Operating side by side with military responders puts them in a precarious situation with regard to neutrality.

The difficulty in making a collaborative response a reality is the single biggest impediment to a more efficient and effective response effort. Along with the lack of familiarity in operating together with other first responders comes the lack of understanding of the way other responders are organized. This in turn breeds confusion and leads to a lack of willingness to better integrate efforts. Breaking down these glaring weaknesses is one of the biggest reasons for having RTAT be made up of Netted Humanitarians that are from responder organizations of all types and backgrounds. As was mentioned earlier, training together and conducting exercises together will certainly contribute to RTAT members operating more effectively in the field. The RTAT team is essentially a mechanism for breaking down the walls of mistrust and building a rapport, understanding and appreciation for the capabilities that each organization brings to relief efforts. It allows for the melding of individual skills and the building of interpersonal relationships between the individual Netted Humanitarians that become a collective strength allowing the team to function effectively and accomplish the mission of assessing the ICT situation.

Inevitably, the individual Netted Humanitarians will develop an understanding of the differences and similarities between their parent organization and that of the other members of the team. Over time, they will develop a richer understanding of the nuances and unique characteristics of the other responder organizations. This knowledge and understanding is quite powerful. This is something that can be shared with their parent organization to promote better understanding and trust between the various organizations. Since the RTAT is designed to be deployed to the disaster site within 12–24 hours, they will likely be the first international responders on the scene. The knowledge they will acquire early in the disaster response will be much

sought after by follow-on forces as they too arrive. RTAT members will be capable of acting as liaisons between the organizations of the IHC, and should play a critical role in breaking down many of the barriers to developing trust and familiarity between the responders. This should promote a greater willingness to share information and work toward a more collaborative response effort.

The preceding examples encapsulate a part of the resulting process improvement that can result from implementation of RTAT and the Netted Humanitarian. However, there are numerous other possible examples, many of which have likely yet to be thought of or discovered. The bottom line is that we know the current process is broken and ineffective. To do nothing is not a viable or sustainable option. The IHC is keenly aware of the current deficiencies in the ICT assessment process and must be willing to move forward toward actively overcoming the current issues.

THIS PAGE INTENTIONALLY LEFT BLANK

V. CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

A. THESIS SUMMARY AND CONCLUSIONS

The primary objective of this thesis was to research and propose a possible solution for overcoming a glaring deficiency in disaster response: conducting effective post-disaster ICT assessments. The concepts of the Netted Humanitarian and the Rapid Technology Assessment Team were meant to address and overcome this deficiency, as well as the many other issues inherent in HA/DR missions. Continuing the trend of ignoring the findings of numerous lessons learned was no longer an option. Therefore, this thesis advocates for change in order to improve the current process and to provide aid to the affected population more quickly and efficiently.

During the course of this research the concept of the Netted Humanitarian morphed from being a stand-alone portable fly away kit (FLAK) that could be carried by individual first responders, into the employment of the Netted Humanitarian within the construct of a team. The concept of a team of netted first responders eventually became linked to the RTAT program, which was funded and sponsored by Office of Secretary of Defense (OSD) from 2010–2012. The vision of the RTAT has taken root among the first responder community, and much progress is being made by many of the stakeholders described in this thesis to come together, collaborate, and move toward implementing many of the concepts described in this research.

The equipment described in this research provides a handful of examples of the current technology available to assist the Netted Humanitarian in carrying out their mission. Without a doubt technologies will continue to evolve and systems will become more and more capable. However, it is equally important that end users and procurement officials ensure that the technology is mature and proven prior to utilizing scarce resources. Furthermore, it is critical to ensure the equipment is interoperable and that open architectures are utilized whenever possible to provide greater flexibility and opportunities for collaboration and information sharing.

B. FUTURE REASEARCH

This thesis focuses primarily on describing the concepts of the Netted Humanitarian and RTAT and discussing the impact they will have on improving the ICT assessment process. Further research is required in order to continue refinement of the concepts and to fully develop mechanisms to take the vision from conceptual to reality. For example, further research is needed for RTAT to refine the ICT assessment forms from their current Excel format into a more robust application and hardware platform that will permit inputting of ICT information in a field environment. Finally, this research viewed the implementation process for RTAT and Netted Humanitarians through a very broad lens, future research could focus more narrowly on the economic and organizational challenges likely to be encountered by the IHC in implementing these concepts.

1. Field Testing Netted Humanitarian FLAK

With regard to developing a FLAK for use by Netted Humanitarians, this thesis focuses on identifying and describing a variety of communications equipment and information technologies that could be included in this kit. Future research should focus on identifying a basic, semi-concrete list of equipment and technologies that will comprise the Netted Humanitarian FLAK. It should be semi-concrete because the kit will certainly require some modification depending on the nature and scope of the disaster. Furthermore, with the rapid pace at which technology is constantly being developed and improved, it is highly desirable to ensure the FLAK is easy to upgrade and composed of interchangeable components. In addition to identifying the equipment that will comprise the kit, future research also needs to consider field testing the technologies in realistic training exercises and disaster response scenarios. Field testing will verify if the equipment and technology in the FLAK is the optimal mix that will allow Netted Humanitarians to successfully carry out their mission. Finally, field testing will also verify the suitability and survivability of the individual components of the kit in a variety of scenarios, as well as geographic and weather conditions.

2. Developing and Maintaining Military Netted Humanitarians

No amount of goodwill on the part of the military first responders will overcome lack of familiarity and training in operating HFN equipment in an HA/DR environment. Military first responders must be trained to understand crucial elements of disaster response, such as how to quickly gain situational awareness, understanding what the information sharing needs are, and who needs what information and when (Janssen, 2010). Furthermore, military responders need to learn how to more tactfully coordinate their relief efforts with those of the rest of the early responder community. This knowledge could also be harnessed in realistic coordinated exercises with other agencies, IGOs and NGOs. This thesis that training specialized HFN operators to work in the chaotic and often frustrating realm of HA/DR is no small feat.

Future research could focus on developing possible methods for identifying and qualifying military members to be Netted Humanitarians in an RTAT. A possible approach for selecting prospective Netted Humanitarian would be to look for military members with a background in portable communications and who have past experience operating in an HA/DR environment. These prospective candidates would receive RTAT training as outlined in this thesis. Enlisted sailors would earn a Navy Enlisted Classification (NEC) after completion of the training. Officer Netted Humanitarians would receive a sub-specialty code that would be annotated in the Officer's Service Record.

Another possible option would be to create RTAT trained rapidly deployable HFN mobile units. These specially trained and supported units would be on standby to support authorities wherever the need arises, whether in response to floods, tornados, earthquakes, or tropical storms. These types of units are likely to be better served in the National Guard units of individual states. Future research should also look for solutions in implementing and maintaining a pool of "on-call" qualified military personnel that are RTAT trained and qualified. This would allow for the military to maintain a searchable database that would simplify the process of providing Netted Humanitarians to RTAT.

3. HA/DR Applications for Data Fusion Software

The realm of data fusion software, specifically in the area of HA/DR, holds a great amount of promise for improving the effectiveness and efficiency of future disaster response missions. Future research could involve conducting an in depth research and analysis on the capabilities and process improvement that could result from data fusion software in assessment and recovery efforts. Additionally, there are many other options that involve more specific mission software. These include easily searchable database repositories for Lessons Learned. Finally, given the open API of data fusion software makers such as Palantir, many possibilities exist for developing third-party applications that can "plug and play" and improve the user experience in the original software. Future research can certainly be conducted on the types of third-party applications that should be considered for development.

LIST OF REFERENCES

Bharosa, N., Lee, J., & Janssen, M. (2010). Challenges and obstacles in sharing and coordinating information during multi-agency disaster response: Propositions from field exercises. *Information Systems Frontiers*, *12*, 49-65.

Big data: Crunching the numbers | The Economist. (n.d.). The Economist - World News, Politics, Economics, Business & Finance. Retrieved from http://www.economist.com/node/2155474

Boland, R. (2006). Portable network extends field communications. *Signal*, *60*, 79–84.

Brewin, B. (2005). Operation tsunami aid. *Federal Computer Week*, *19*, 18–27.

Crenshaw, L. (2012). *Defense industry daily: 2012 Defense budget outlook: The new uncertainty.* Retrieved from http://www.defenseindustrydaily.com/2012-Defense-budget-outlook-The-new-certainty-07375/

Delorme (2011). *Delorme inreach*. Retrieved from http://www.inreachdelorme.com/product-info/

Denning, P. (2006). Hastily formed networks. *Communications of the ACM*, *49*, 15–20.

Denning, P. & Hayes-Roth, R. (2006). Decision making in very large networks. *Communications of the ACM*, *49*, 19–23.

Department of Defense (DoD) (2009). *Directive 3000.05, Military support for stability, security, transition and reconstruction*. Retrieved from http://www.dtic.mil/whs/directives/corres/pdf/300005p.pdf

Department of Homeland Security (DHS) (2006). The federal response to Hurricane Katrina: Lessons learned. Retrieved from http://library.stmarytx.edu/acadlib/edocs/katrinawh.pdf.

Donahue, A. & Tuohy, R. (2006). Lessons we don't learn: A study of the lessons of disasters, why we repeat them, and how we can learn from them. *Homeland Security Affairs*, *2*, 1–28.

Exelis. (2012). *RO tactical radio.* Retrieved from http://www.exelisinc.com/solutions/RO-Tactical-Radio/Pages/default.aspx.

Gibbons, D. (2007). *Communicable crisis.* Charlotte: Information Age Publishing.

Honegger, B. (2010). *Responding to disaster: The Naval Postgraduate's hastily formed networks research group deploys to Haiti after devastating earthquake.* Retrieved from *http://www.nps.edu/Images/Docs/InReview/2010/InReview_April_10_low_res.pdf*

Honig, Z. (2013*). Live from Camp Pendleton with ViaSat SurfBeam 2 Pro Portable*. Retrieved from http://www.engadget.com/2012/02/13/viasat-surfbeam-2-pro-portable/

Horan, T., & Schooley, B. (2007). Time-critical information services*. Communications of the ACM*, *50*, 73–78.

Hughes. (2012). *Hughes 9202 BGAN land portable satellite terminal.* Retrieved from http://www.hughes.com/ProductsAndTechnology/MobileSatSystemsTerminals/Hughes_9202_BGAN_Land_Portable_Satellite_Terminal/Pages/default.aspx

Inmarsat. (2012). *Isat phone pro*. Retrieved from http://www.inmarsat.com/services/IsatPhoneProInmarsat

Iridium. (2012). *Iridium Extreme Satellite Phone*. Retrieved from http://www.iridium.com/products/IridiumExtremeSatellitePhone.aspx

Janssen, M. (2010). Advances in multi-agency disaster management: key elements in disaster research. *Information Systems Frontiers*, *12*, 1–7.

Koks, D., & Challa, S. (1994). *An introduction to Bayesian and Dempster-Shafer data fusion.* Retrieved from http://www.dsto.defence.gov.au/publications/2563/DSTO-TR-1436.pdf

Lim, M. & Ng, M. Y. C. (2007). *An integrated architecture to support hastily formed network* (Master's thesis). Monterey: Naval Postgraduate School. Retrieved from http://edocs.nps.edu/npspubs/scholarly/theses/2007/07Dec_Lim_Meng.pdf

Palantir. (2012). *What we do*. Retrieved from http://www.palantir.com/what-we-do/

Romano, S. F. (2011). Logistics planning and collaboration in complex relief operations. *Joint Force Quarterly*, *62*, 96–103.

Steckler, B. (2012). *Rapid Technology Assessment Teams (RTAT) executive summary*. Monterey: Naval Postgraduate School.

Steckler, B., Bradford, B. L., & Urrea, S. (2005). *Hastily formed networks for complex humanitarian disasters: After action report and lessons learned from the Naval Postgraduate School's response to Hurricane Katrina.* Monterey: Naval Postgraduate School.

Tatham, P., & Kovacs, G. (2010). *Developing and maintaining trust in post-disaster hastily formed networks.* Retrieved from http://download.springer.com/static/pdf/471/chp%253A10.1007%252F978-3-642-pdf .

United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA). (2013). *What we do.* Retrieved from http://www.unocha.org/what-we-do/coordination/overview

ViaSat. (2012). *Surfbeam portable pro 2*. Retrieved from http://www.viasat.com/files/assets/SurfBeam2_ProPortable_010_web.pdf

Wentz, L. (2006). *An ICT primer: Information and communication technologies for civil-military coordination in disaster relief and stabilization and reconstruction.* Retrieved from http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA454071.

THIS PAGE INTENTIONALLY LEFT BLANK

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center
   Ft. Belvoir, Virginia

2. Dudley Knox Library
   Naval Postgraduate School
   Monterey, California

3. Director, NPS HFN Center
   Brian Steckler
   Naval Postgraduate School
   Monterey, California

4. Director, NPS Virtualization/Cloud Computing Lab
   Albert Barreto
   Naval Postgraduate School
   Monterey, California

5. Dr. Glenn Cook
   Naval Postgraduate School
   Monterey, California

6. Chair, Department of Information Sciences
   Dr. Dan Boger
   Naval Postgraduate School
   Monterey, California

7. Mr. William Barlow
   Deputy for Information Sharing
   Information Enterprise Strategy & Policy (IESP)
   Office of the DoD Chief Information Officer
   Arlington, Virginia

8. Lieutenant Chris Gutierrez
   Naval Postgraduate School
   Monterey, California